Advant® OCS
with Master Software

S100 I/O Hardware

Reference Manual

3BSE 002 413R301

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Appendix A - Address Jumpering

A.1 General A-1

Chapter 1 Introduction

1.1 General Information

This manual describes the hardware involved in the process interface S100 I/O.

This manual begins with a description of the bus extender boards, the I/O subrack, and voltage regulators. The main part lists all the I/O boards in alphabetical order, starting with AI boards. For each board type, you will see examples of how to connect the boards to the process.

1.2 Product Overview

The S100 I/O consists of several I/O boards, internal cables, and connection units covering a wide variety of applications and specific needs.

The I/O boards are divided into groups, depending on their function. Within each group, there are several I/O boards with differing functionality and complexity. You will find an overview of all available I/O boards in Table 1-1.

Table 1-1. List of all I/O Boards and Connection Units

I/O Board Type	I/O Board
Analog input boards	DSAI 110, 130, **130A**, 133, **133A**, 145, 146, 151,155 and **155A**
Analog output boards	DSAO 110, 120, **120A**, 130, and **130A**
Analog input/output board	DSAX 110 and **110A**
Digital input boards	DSDI 110A, **110AV1**, 115, 120A, **120AV1** and 125
Digital output boards	DSDO 110, 115, **115A**, 120, 131 and 140
Pulse counter boards	DSDP 110, 140A, 150 and 170
Application specific boards	DSXW 110, 111 and DSDC 111
Auxiliary unit	DSTY 101
Connection unit DSTA	DSTA 001A, **001B**, 002A, **002B**, 133, **135**, 137, **138**, 155, **155P**, 156, **156B**, 170, **171**, 180 and **181**
Connection unit DSTD	DSTD 108, **108P**, 108L, **108LP**, **109P**, 190, **190V1**, 196 and **196P**

Some boards are modernized and have extensions A, B, V1, or P (Pluggable screw terminals) or new type designations. Theses board will in most cases replace the previous boards.
The modernized board are **bold** in Table 1-1.

To each I/O board there is a corresponding cable connecting it with at least one type of matching (board oriented) connection unit for process interface.

For some S100 I/O boards there is in addition an alternative (object oriented) way to interface with process.

Object Oriented Connection Units (OOCU) provides a cable landing for objects (motors, on/off valves, and loops) at plug in connectors. Both input and output boards are internally connected with corresponding cables to these connection units.

A single I/O subrack can contain up to 20 I/O boards, see Figure 1-1. You can connect additional I/O subracks via bus extenders or optical modems to increase the I/O board capacity.

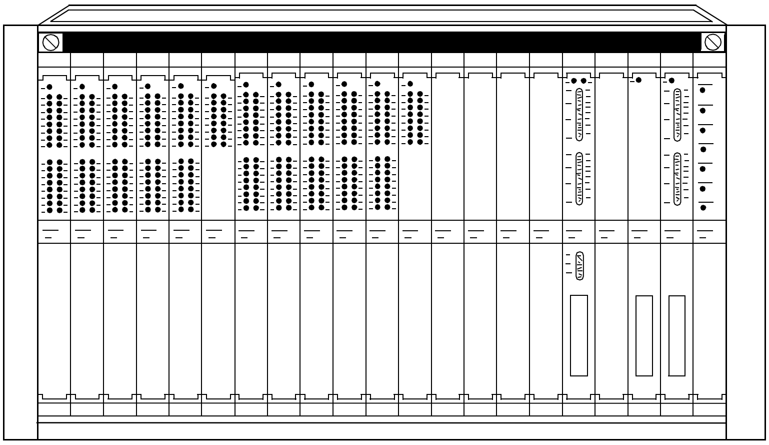


Figure 1-1. I/O Boards Mounted in I/O Subrack and Bus Extender Board at Far Right

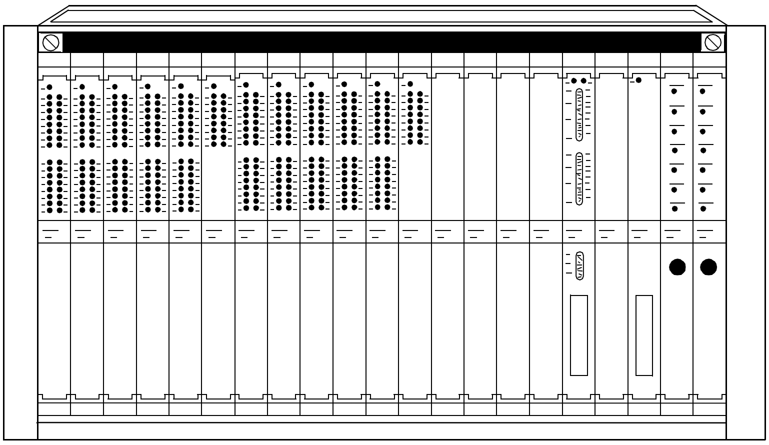


Figure 1-2. I/O Subrack with two Bus Extender Boards DSBC 174 for Redundancy.

You can connect up to five I/O subracks in a chain where each I/O subrack contains a bus extender slave board (DSBC 173A or DSCB 174) and up to 20 I/O boards if PM510 is used. An external bus extender master board connects the I/O subracks to the Controller’s main CPU, see Figure 1-3.

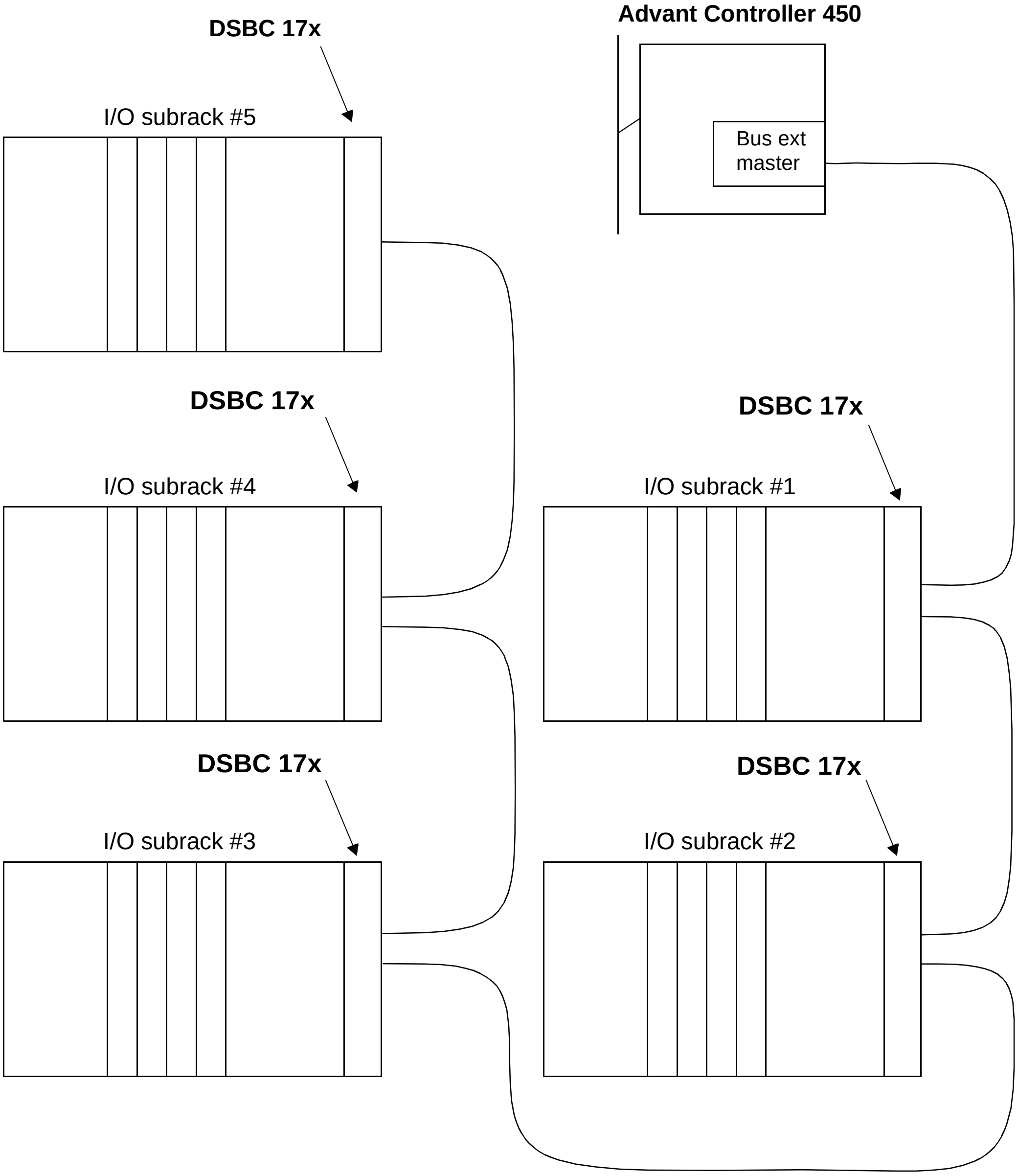


Figure 1-3. Advant Controller 450 - I/O Subracks Chained Together with Bus Extension Cables

The optical bus extension is a serial link designed for point-to-point connection (multidrop configuration is not possible) of up to 5 I/O subracks in the far-side. Between the I/O subracks in the far side, the normal bus extension is used (with DSBC 173A or DSBC 174).

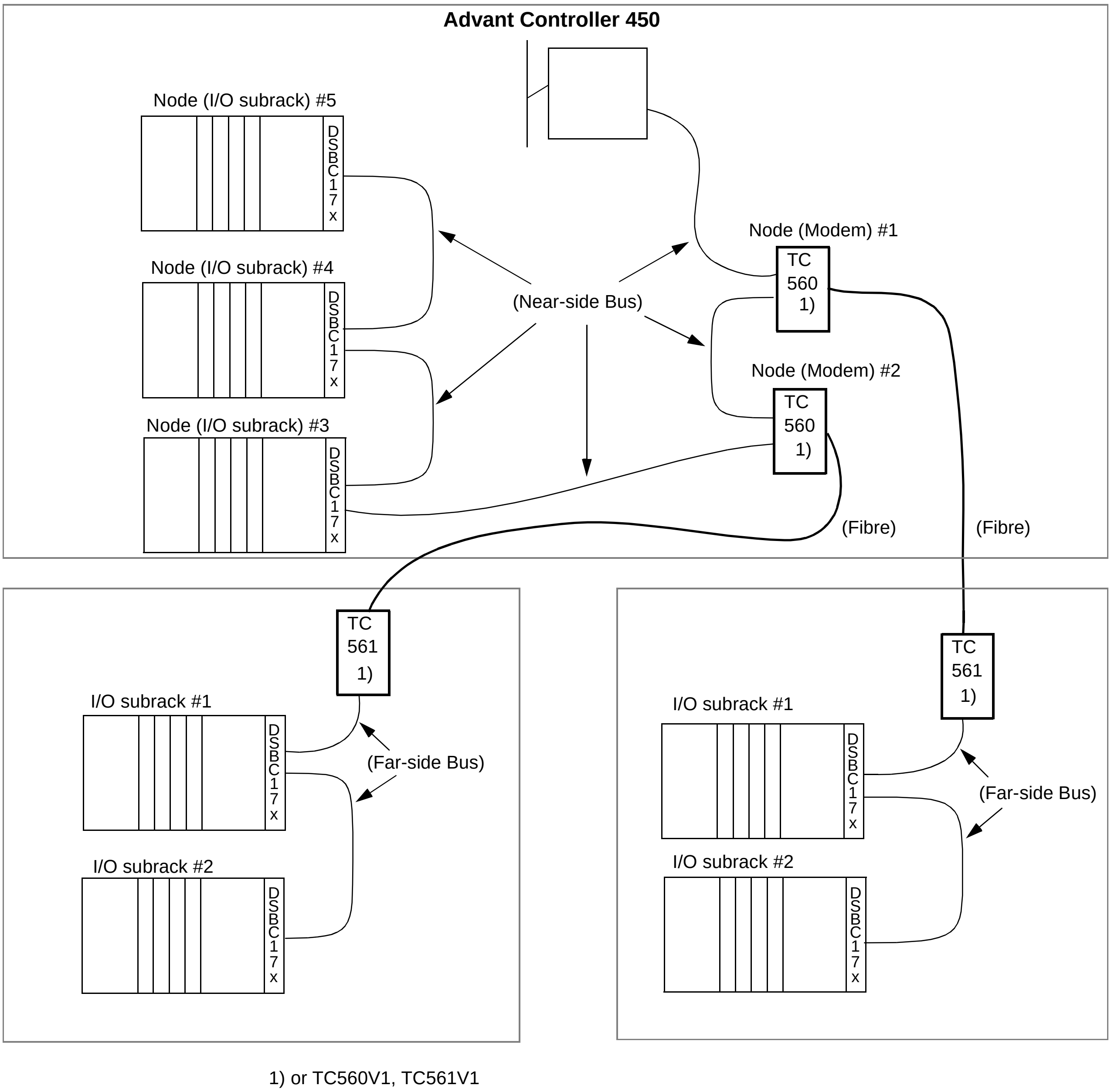


Figure 1-4. Example of Optical Bus Extension with Advant Controller 450

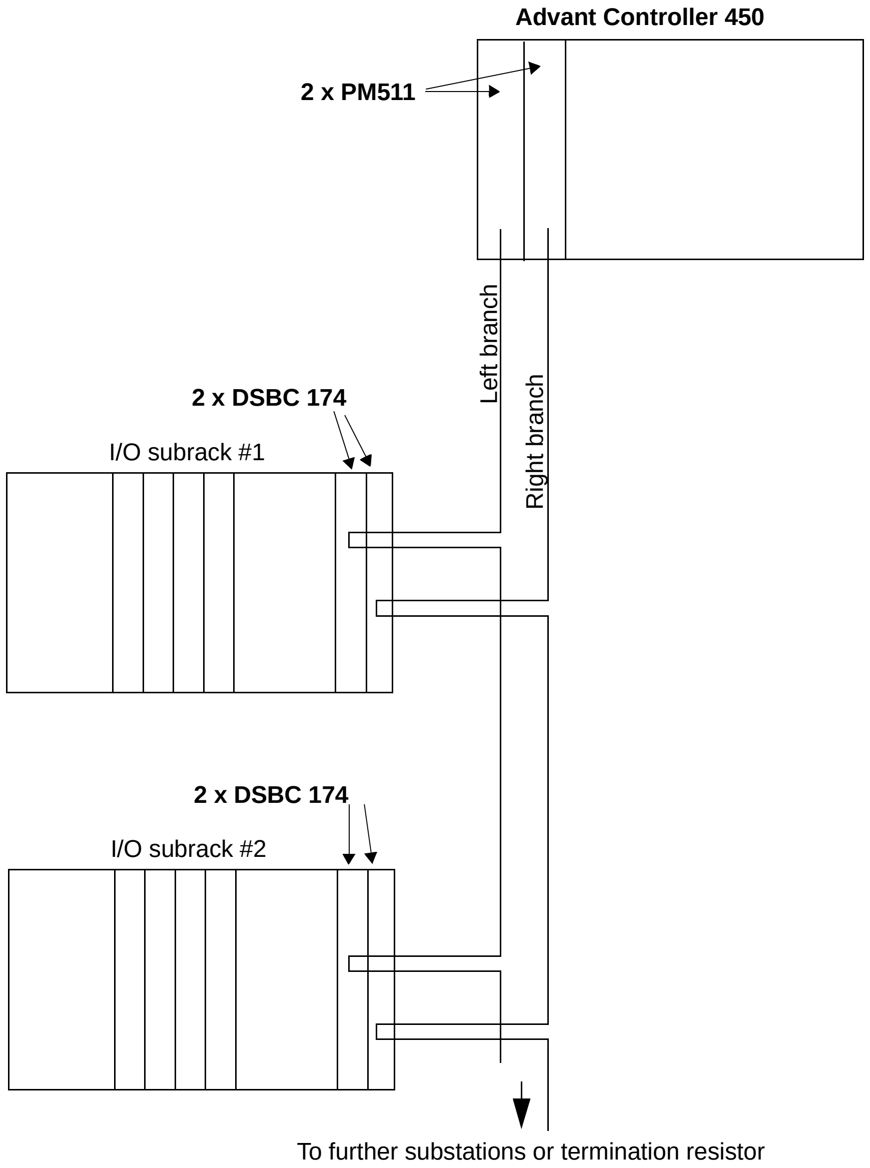


Figure 1-5. Redundant Configuration with DSBC 174

In redundant configurations two CPUs PM511are used. One is connected to the left bus branch, one to the right bus branch. In the I/O subracks two DSBC174 are used, the left is connected to the left bus branch, the right one is connected to the right bus branch

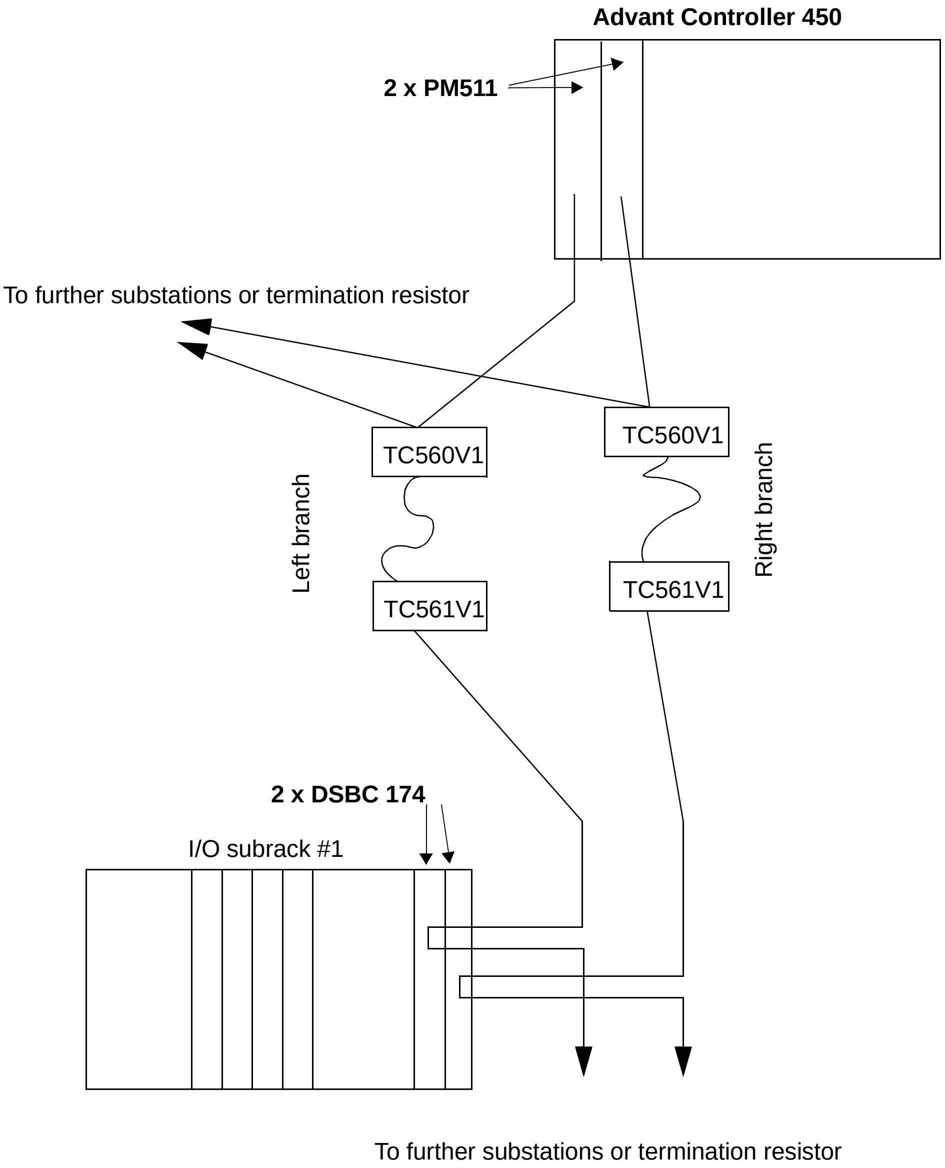


Figure 1-6. Redundant Configuration with Optical Bus Extension

There is also a special I/O subrack for Advant Controller 410. In this version, the first six slots are occupied by the Controller's main CPU and up to 15 I/O boards can be inserted in the remaining slots. Bus extenders cannot be used in this version.

NOTE

From this point forward, when the term "I/O subrack" is used, it refers to both types of I/O subracks, unless otherwise stated.

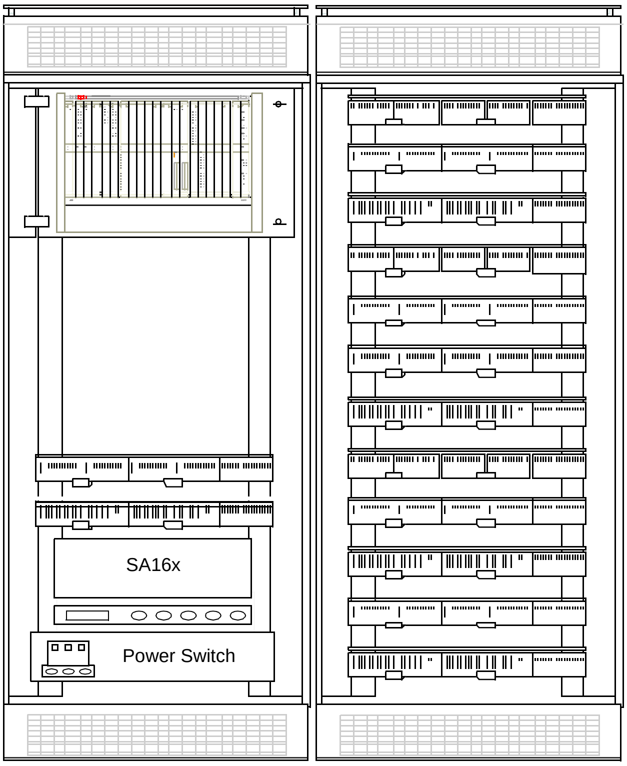


Figure 1-7. Typical Cabinet Layout for an I/O-rack with Board Oriented Connection Units

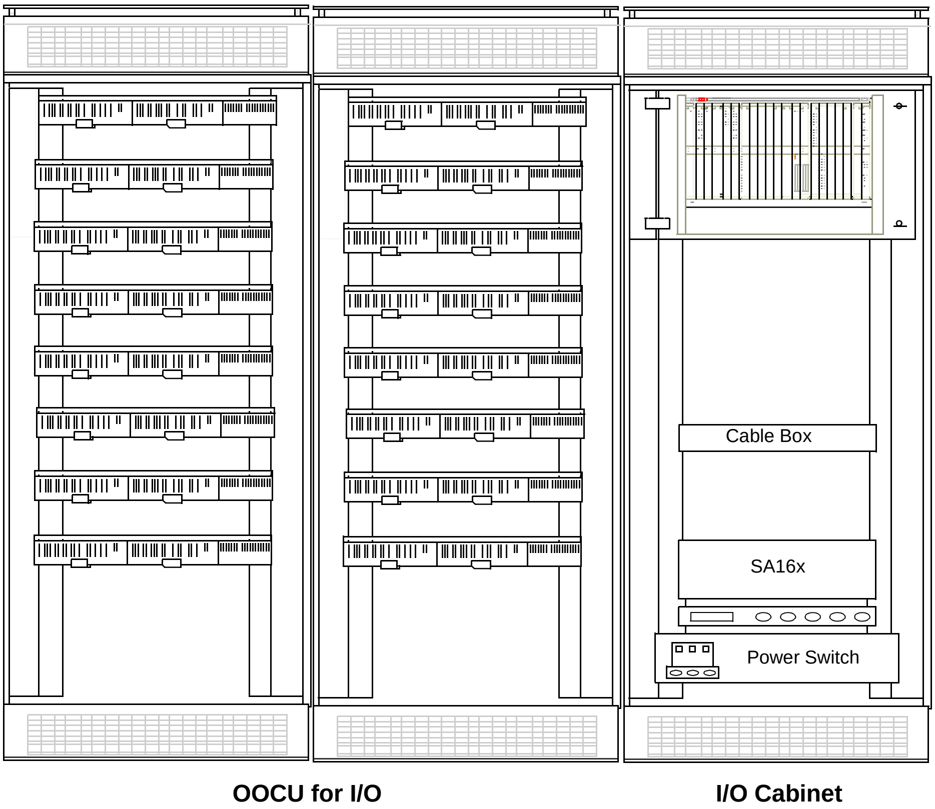


Figure 1-8. Typical Cabinet Layout for an I/O-rack with Object Oriented Connection Units

Chapter 2 Bus Extender Boards used with CPU PM510

2.1 General

There are two extender boards used in the S100 I/O when used with CPU PM510:

- Bus extender master - CI540
- Bus extender slave - DSBC 173A.

The CI540 is a submodule that you plug into a slot on a submodule carrier. Insert the DSBC 173A in the last position of the I/O subrack. Together, they interface between the Controller's main CPU and the backplane bus (PBC) on the I/O subrack.

It is possible to use DSBC 174 bus extender as a replacement for DSBC 173A if its jumpers are set properly. See Section 3.3.3 Bus Extender Mode Jumper.

NOTE

The I/O subrack for Advant Controller 410 cannot use the bus extension feature.

The following functions are supported:

- Bus clock signals, generated for the backplane bus on the I/O subrack
- Supervision of functions such as fans and redundant regulators
- LED's on the DSBC 173A front, indicating status of the I/O subrack.

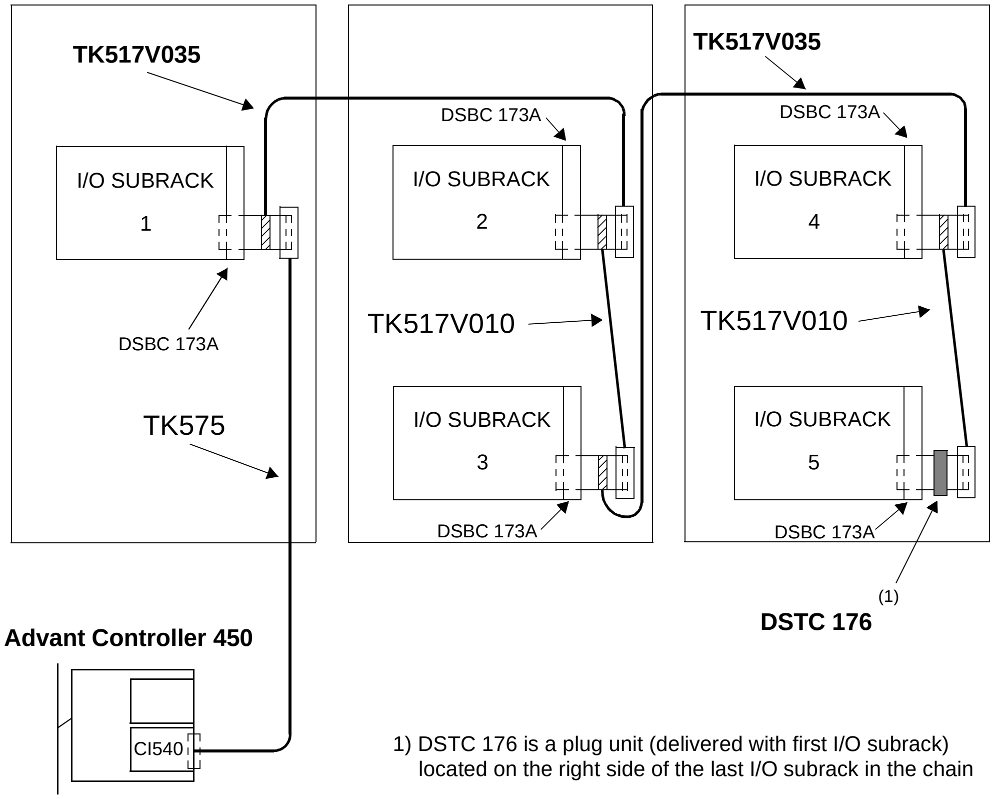


Figure 2-1. Example of How to Connect CI540 to DSBC 173A in a RE Cabinet

The bus extender (see Figure 2-1) consists of:

- One master module, CI540, on a submodule carrier
- One to five slave boards, DSBC 173A, each located in a separate I/O subrack
- Standard cables which connect between the CI540 and the first DSBC 173A, and between the I/O subracks.

The maximum length of the bus extension is 12 m; that is, the total length of the bus cables used may not exceed 12 m.

2.2 Front Panels

Figure 2-2 and Figure 2-3 show the front panels of the bus extender boards CI540 and DSBC 173A.

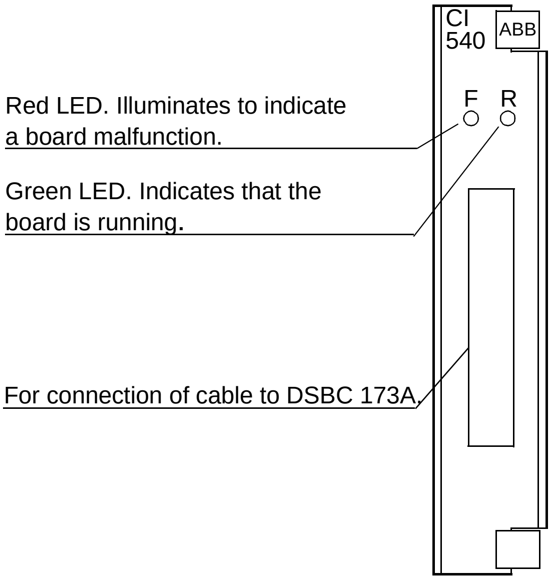
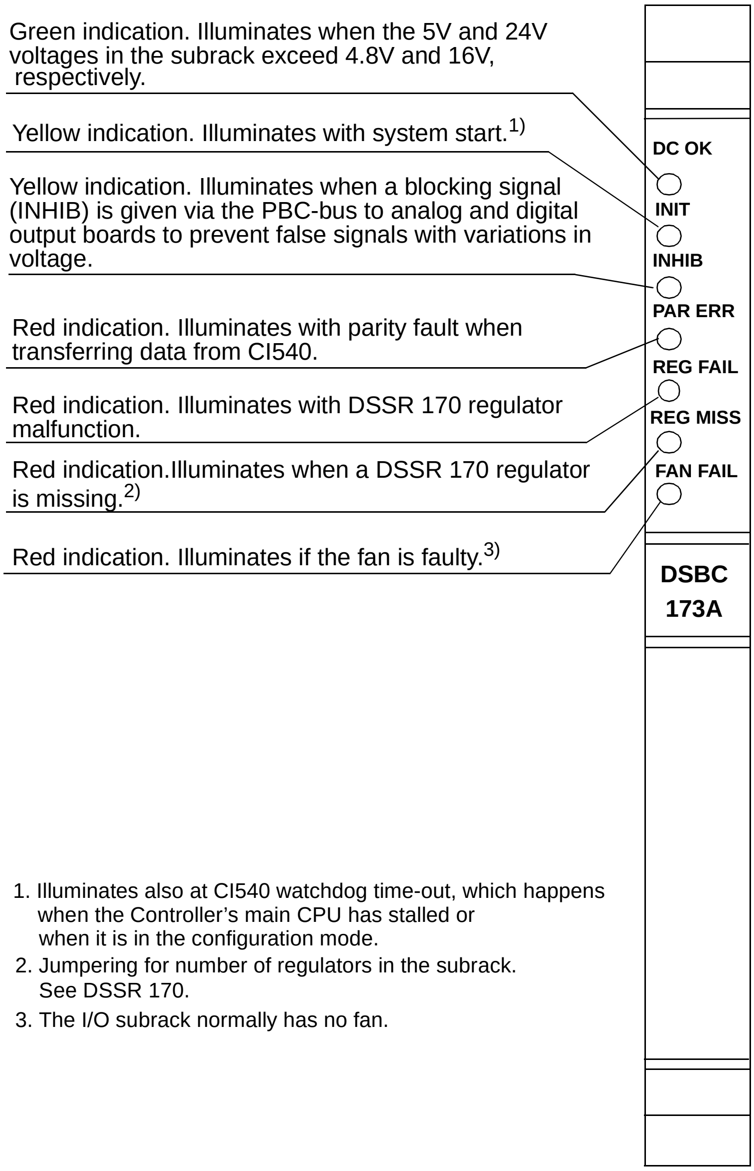

CI
540
ABB
F
R
Red LED. Illuminates to indicate a board malfunction.
Green LED. Indicates that the board is running.
For connection of cable to DSBC 173A.

Figure 2-2. Front Panel of the Bus Extender Board CI540 (Master)



Green indication. Illuminates when the 5V and 24V voltages in the subrack exceed 4.8V and 16V, respectively.

Yellow indication. Illuminates with system start.[1]

Yellow indication. Illuminates when a blocking signal (INHIB) is given via the PBC-bus to analog and digital output boards to prevent false signals with variations in voltage.

Red indication. Illuminates with parity fault when transferring data from CI540.

Red indication. Illuminates with DSSR 170 regulator malfunction.

Red indication.Illuminates when a DSSR 170 regulator is missing.[2]

Red indication. Illuminates if the fan is faulty.[3]

1. Illuminates also at CI540 watchdog time-out, which happens when the Controller’s main CPU has stalled or when it is in the configuration mode.
2. Jumpering for number of regulators in the subrack. See DSSR 170.
3. The I/O subrack normally has no fan.

Figure 2-3. Front Panel of the Bus Extender Board DSBC 173A (Slave)

2.3 Jumpering

The CI540 has no jumpers. The bus extender board DSBC 173A’s jumpers are shown in the Table 2-1 and Figure 2-4 below.

Table 2-1. Jumpering of the Bus Extender Board DSBC 173A

Jumper Function	**Jumper Groups for DSBC 173A**
Selective/Global INHIB	S2
Production Test	S1

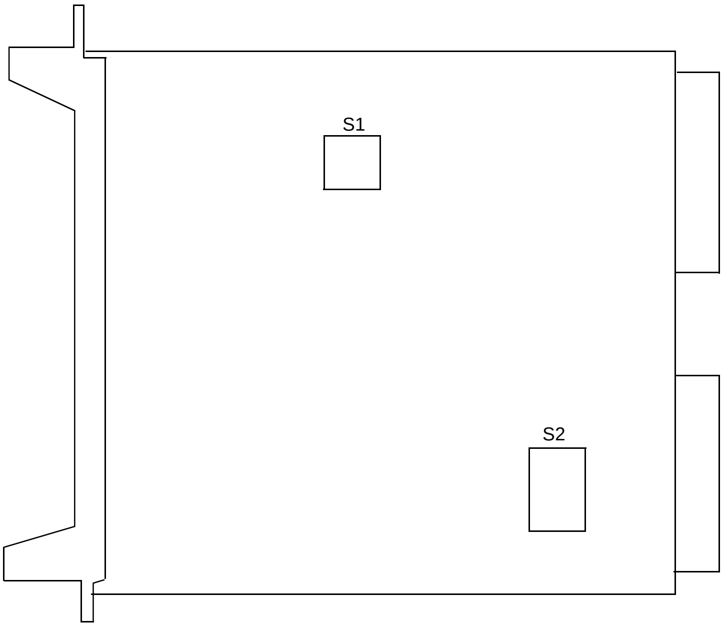


Figure 2-4. Bus Extender Board DSBC 173A, Location of Jumper Groups

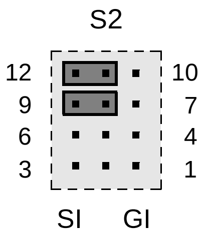
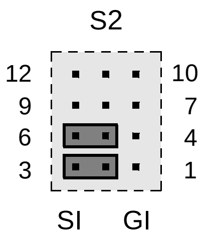
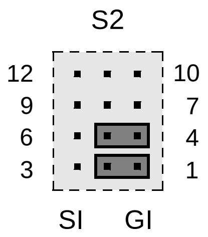
2.3.1 Selective/Global INHIB Jumper

The INHIB function on the I/O subrack is controlled by the DSBC 173A’s S2 jumper.

A selective INHIB limits the INHIB signal to the local I/O subrack. For example, a voltage failure on the controller side disconnects all I/O subracks, whereas a voltage failure in a specific I/O subrack does not affect any other I/O subrack.

On the other hand, a global INHIB disconnects all I/O subracks if, for example, there is a voltage failure in one of them.

Table 2-2. Selective/Global INHIB Jumper on DSBC 173A

Function	DSBC 173A
Selective INHIB function (Normal position)	
Selective INHIB function (Can not be used with optical bus extension)	
Global INHIB function (Can not be used with the Bus Extender Board CI540.)	

2.3.2 Production Test Jumper

The jumper group S1 on the bus extender board DSBC 173A is used for production test purposes only. It shall always be set according to Figure 2-5.

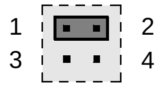


Figure 2-5. Production Test Jumper S1 on DSBC 173A

2.4 Optical Bus Extension

2.4.1 General Description

The optical bus extension is a complement to the normal S100 I/O bus extension used in the products Advant Controller 450.

NOTE

You can not use this optical bus extension in Advant Controller 410.

With the optical bus extension I/O subracks can be placed up to 500 meters from the central subrack of the controllers/process stations.

The optical bus extension is a serial link designed for point-to-point connection (multidrop configuration is not possible) of up to 5 I/O subracks in the far-side. Between the I/O subracks in the far side, the normal bus extension is used.

The optical bus extension consists of two modems, TC560 in the near-side and TC561 in the far- side. Between the modems there is a serial link containing two optical fibres, one for sending and one for receiving signals. Link redundancy is not possible.

NOTE

Whenever references are made to TC560 and TC561, TC560V1 and TC561V1 could be used instead.

In the near-side up to 5 “nodes”, I/O subracks with DSBC 173A or TC560, can be connected with the normal bus extension.

All supervision signals connected to the DSBC 173A in the far-side are transferred via the optical bus extension to CI540.

The modems can be powered by two independent 24V d.c. supplies internally connected to each other via diodes.

Two additional Supervision Signals (FA, FB) are generated internally from two 24V Digital Inputs on the far-side, and transferred to two 24V Digital Outputs on the near-side. In this way, a supervision of the power supply voltages on the far-side can be carried out on the near-side.

2.4.2 Bus Extension Configuration for S100 I/O Subracks

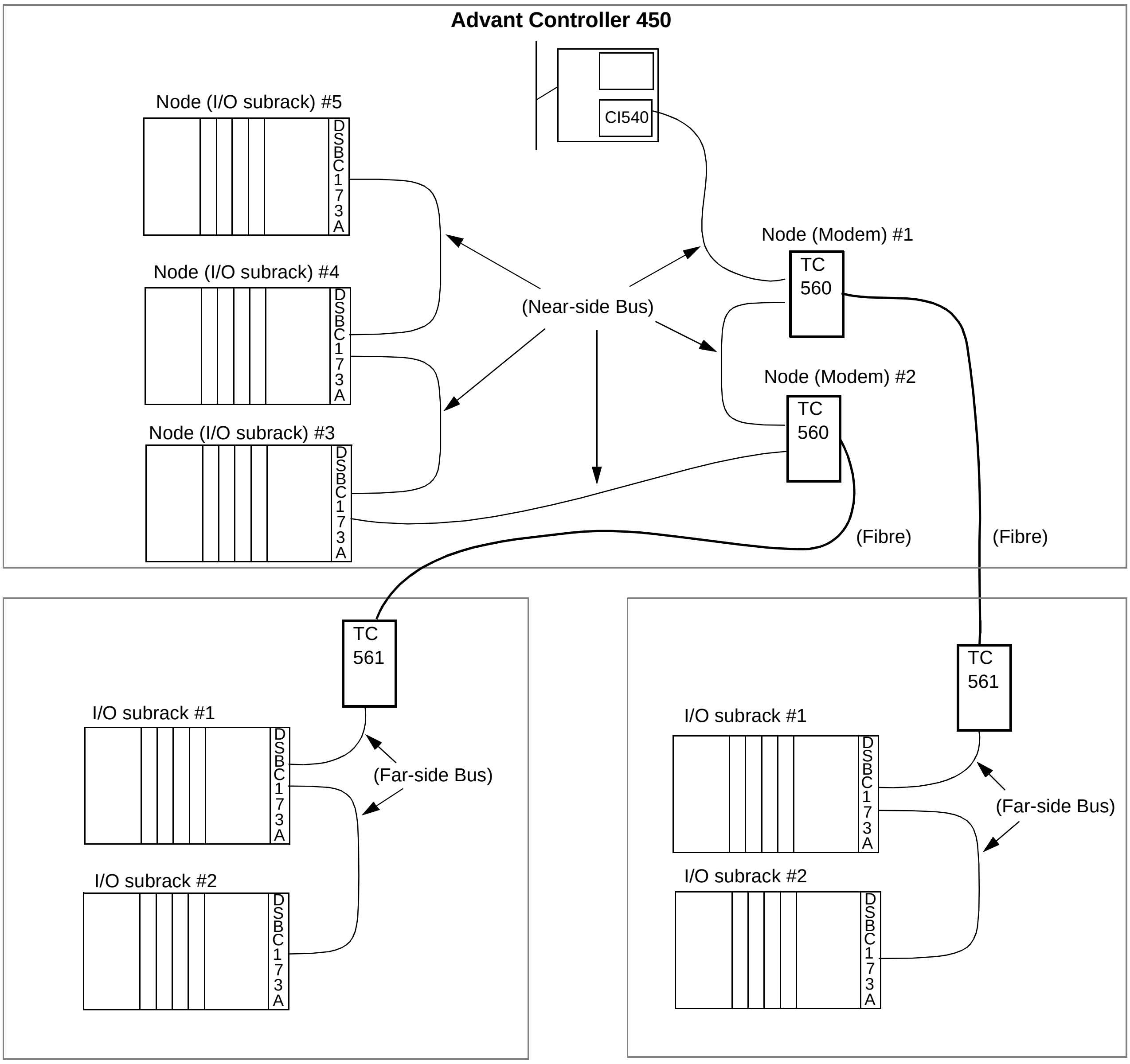


Figure 2-6. Example of Optical Bus Extension with Advant Controller 450

Advant Controller 450 - I/O subracks chained together with Bus Extension Cables **and** Optical Bus Extensions.

2.4.2.1 Components

The following components are tied to the optical bus extension:

TC560	Modem	(Near-side)
TC561	Modem	(Far-side)
TK560	Interconnector	(Near-side)
TX560	Terminator	(Near-side)
TK580	Cable Assembly	(Near-side; 1,8m)
TK580V007	Cable Assembly	(Near-side; 0,7m)
TK575	Cable Assembly	(Near-side, Far-side; 3,5m)

2.4.2.2 Boundary Conditions

Boundary Conditions (See Figure 2-7 - Figure 2-8)

Near-side Bus

- Max total bus cable length: 12 m
- Max no. of DSBC 173A and TC560: 5
- TK560 as well as TX560 shall be mounted on front of TC560. (See also Figure 2-12)[1].
- In case of maintenance, TK560 as well as TX560 may be removed from TC560.
- It is recommended that any DSBC 173A on the near-side shall be connected *after* the TC560s on the bus (see Figure 2-8).
- The above recommendation implies that if any DSBC 173A is connected on the near-side, the Terminator DSTC 176 applies instead of TX560.
- The connection between CI540 and TK560 (or TX560) takes place by means of TK580.
- The connection between TK560 and DSBC 173A takes place by means of TK575.

Serial Link

•	Medium:	Optical Fibre (dual)
•	Type:	62,5/125 µm (50/125 µm also possible)
•	Connection:	Bayonet ST Connector Receiptables (on TC560/TC561)
•	Max. length:	500 m

Far-side Bus

- Max total bus cable length: 12 m
- Max no. of DSBC 173A: 5
- The connection between TC561 and DSBC 173A takes place by means of TK575.

---

[1] Due to this, the clearance distance from the front of TC560 shall be not less than 90 mm.

2.4.2.3 Supply Voltage Status Transfer

Supervision of the power supply voltages on the far-side (24VA and 24VB) is done by connecting 24VA and 24VB through a Diode/Voting Unit (either DSSS 170 or DSSS 171) to the inputs FA and FB of TC561, and the outputs FA and FB of TC560 on the near-side to either TC520. If more than one optical bus extension are connected to the same CI540, the outputs from the TC560s may be connected in parallel in a wired-or configuration (see also Figure 2-9 and Figure 2-11).

Power Status (See Figure 2-9).

Near-side Outputs

- 24V Digital outputs, 2 channels (non-isolated) FA and FB
- Short-circuit proof; min. load 2,2 kOhm (corresponding to max. 10 mA).
- Connection: 3-pin jackable plints (cable area = 0.5 - 2,0 mm^2)

NOTE
Each Near-side output is controlled by a corresponding Far-side input.

NOTE
Near-sid outputs may be chained together in a “wired-or” configuration.

Far-side Inputs

- 24V Digital inputs, 2 channels (non-isolated) FA and FB
- Input switching level: 13.0V +/- 1.0V
- Connection: 3-pin jackable plints (cable area = 0.5 - 2,0 mm^2).

When employing either the Diode Unit DSSS 170 or the Voting Unit DSSS 171, (see also Section 2.4.2.4 Powering the Modems), the corresponding Status Connections are:

Table 2-3. Status Connections

STATUS	TC560/TC561	DSSS 170	DSSS 171/DSBB 188
Sup. 24VA	X1+X2: 1 (FA)	X3: 14 (24VFAILA)	X6+X7: 1 (FAIL24V_A)
Sup. 0VA	X1+X2: 3 (0V)	X3: 5	X1: b (0V_A)
Sup. 24VB	X1+X2: 2 (FB)	X3: 16 (24VFAILB)	X6+X7: 2 (FAIL24V_B)
Sup. 0VB	X1+X2: 3 (0V)	X3: 6	X2: b (0V_B)

2.4.2.4 Powering the Modems

Power requirements of TC560 or TC561 (See Figure 2-10)

- Supply: +24V d.c.
- Voltage range: 18 - 30V.
- Can be connected to two independent power sources (internally united by means of diodes).
- Power consumption, Near-side: 5.6W (Digital output channels: NOT included)
- Power consumption, Far-side: 6.6W (Digital input channels: negligible)
- Connection: 2-pin jackable plints (cable area = 0.5 - 2,0 mm^2).

NOTE

For supervision reasons, the +24V Supply on the near-side shall correspond to that of the Central Subrack, and the +24V Supply on the far-side shall correspond to that of the I/O Subrack(s). This implies that when employing either the Diode Unit DSSS 170 or Voting Unit DSSS 171, (see Section 2.4.2.3 Supply Voltage Status Transfer), the corresponding Power Connections are:

Table 2-4. Power Connections

POWER	TC560/TC561	DSSS 170	DSSS 171/DSBB 188
24VA	X1: 5 (24V)	X3: 1	X1: a (24V_A)
0VA	X1: 6 (0V)	X3: 5	X1: b (0V_A)
24VB	X2: 5 (24V)	X3: 3	X2: a (24V_B)
0VB	X2: 6 (0V)	X3: 6	X2: b (0V_B)

2.4.2.5 LED Indications

LED Indications on TC560 or TC561(See Figure 2-11)

- RF = Remote Failure (Red)[1)]
- P = +5V_OK (Green)
- INH = INHIBIT (Yellow)
- INIT = INIT (Yellow)
- TX = Transmission (Yellow)
- RX = Reception (Yellow).

NOTE

The same LED Indicators are found on Near-side (TC560) as well as Far-side (TC561).

---

1. This is a sum error indication for all five Remote Status Signals (REGMISS, REGFAIL, FANFAIL, FA, FB),

2.4.2.6 Use and Maintenance Guidelines

NOTE

In case of maintenance, such as replacement of a unit (TC560 or TC561) or replacement of Optical Fibre, ***it is recommended to disconnect the power of the relevant unit before carrying out any such maintenance.***

This implies that if TK560 or TX560 is to be disconnected from (or connected to) TC560, this should be done only after the power of TC560 has been disconnected.

If maintenance of a far-end unit (TC561) takes place, this may be done without disconnecting the power of the near-end unit (TC560), and vice versa.

If the power of a TC560 is to be disconnected, then the Status-signals (FA, FB) of that unit must also be disconnected, since the two 24 V Digital Outputs only work properly with a 24 V Supply connected.

CAUTION

Never disconnect an Optical Fibre of a unit under running condition, since this may cause disturbances on the on-going data traffic between the CPU and the I/O devices.

CAUTION

When using Cable Assembly TK575, always make sure that Cable Lug M3 has a good ground connection to the relevant subrack.

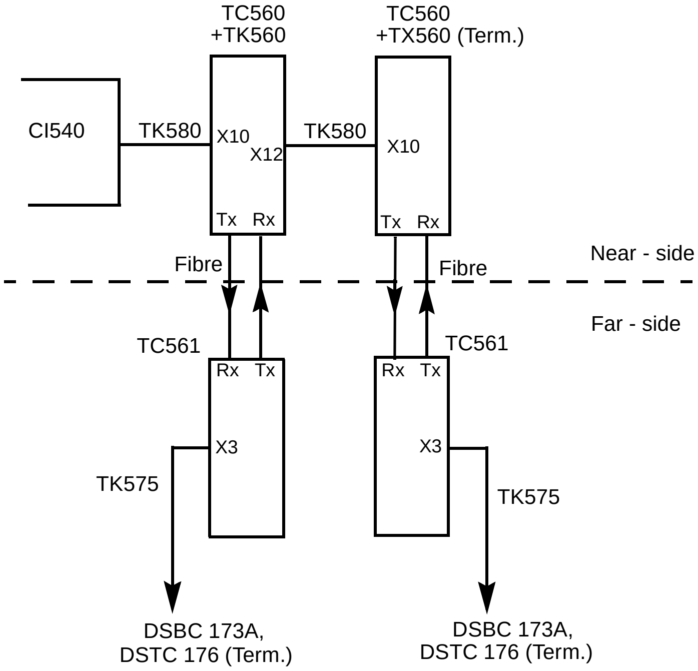


Figure 2-7. AC 450 with TC560 on Near-side

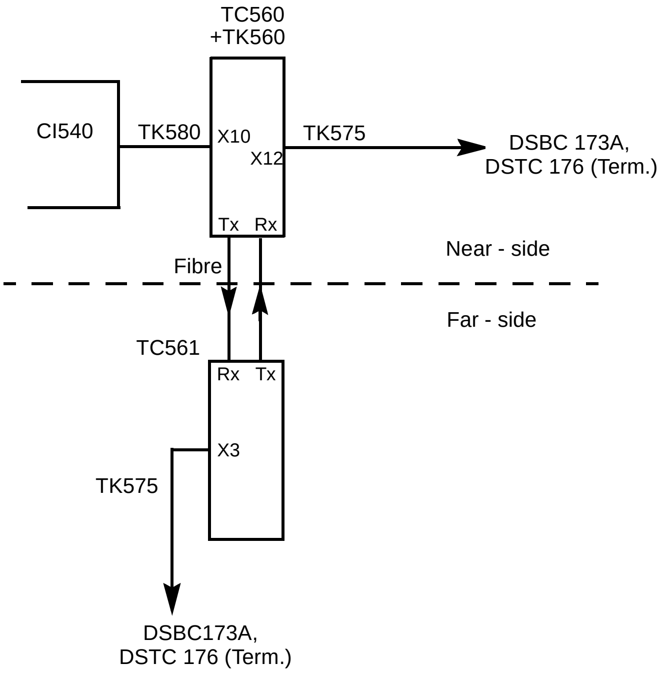


Figure 2-8. AC 450 with both TC560 and I/O Subracks on Near-side

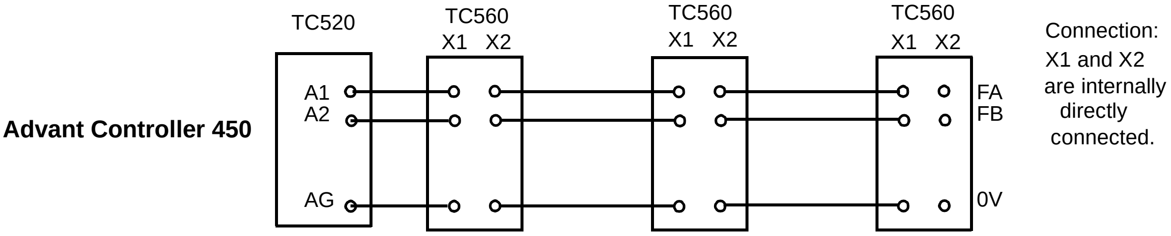


Figure 2-9. Connection of Supervision Signals from TC560

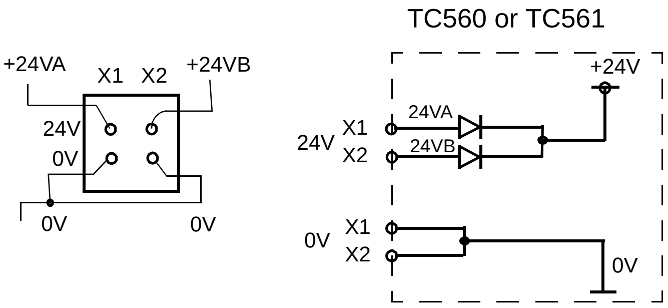


Figure 2-10. Connection of Supply Voltage to the Modems

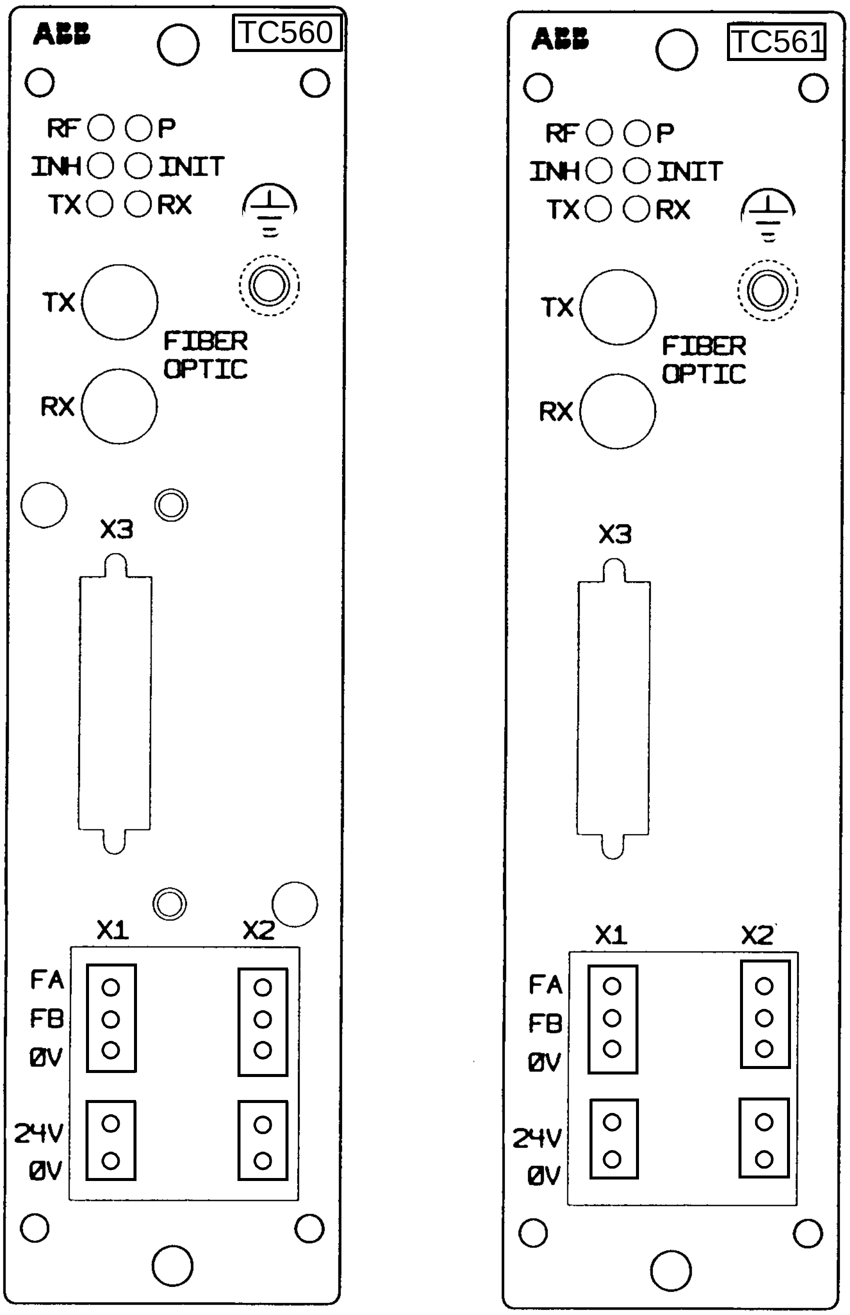


Figure 2-11. Front Plates of TC560 and TC561

All measurements in mm

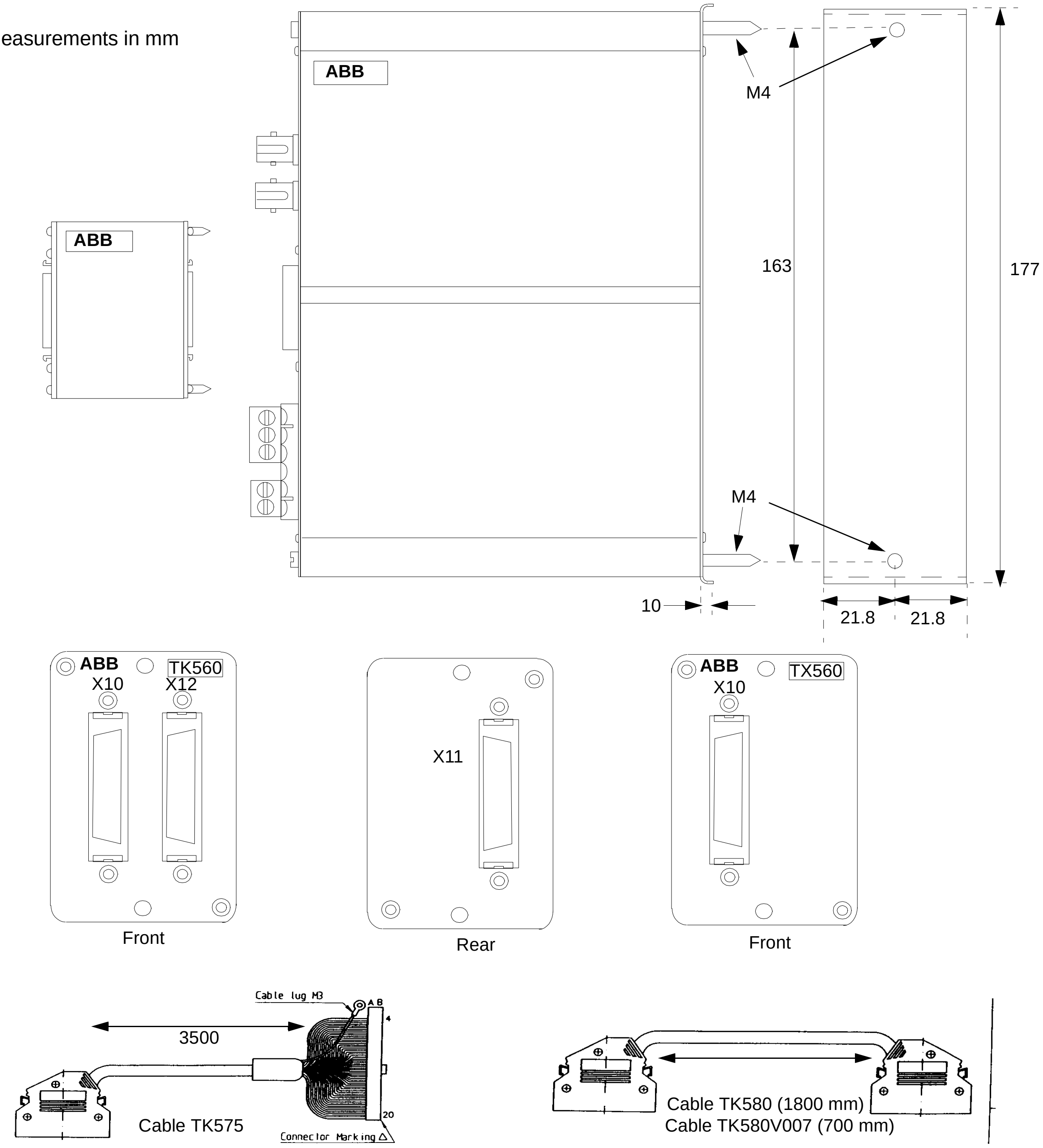


Figure 2-12. Mechanics

Chapter 3 Bus Extender Board used with CPU PM511

3.1 General

The bus extender used with CPU PM511 is DSBC 174. PM511 incorporates a bus extender function that makes it possible to connect it directly to DSBC 174. This bus extender could be used in three different configurations:

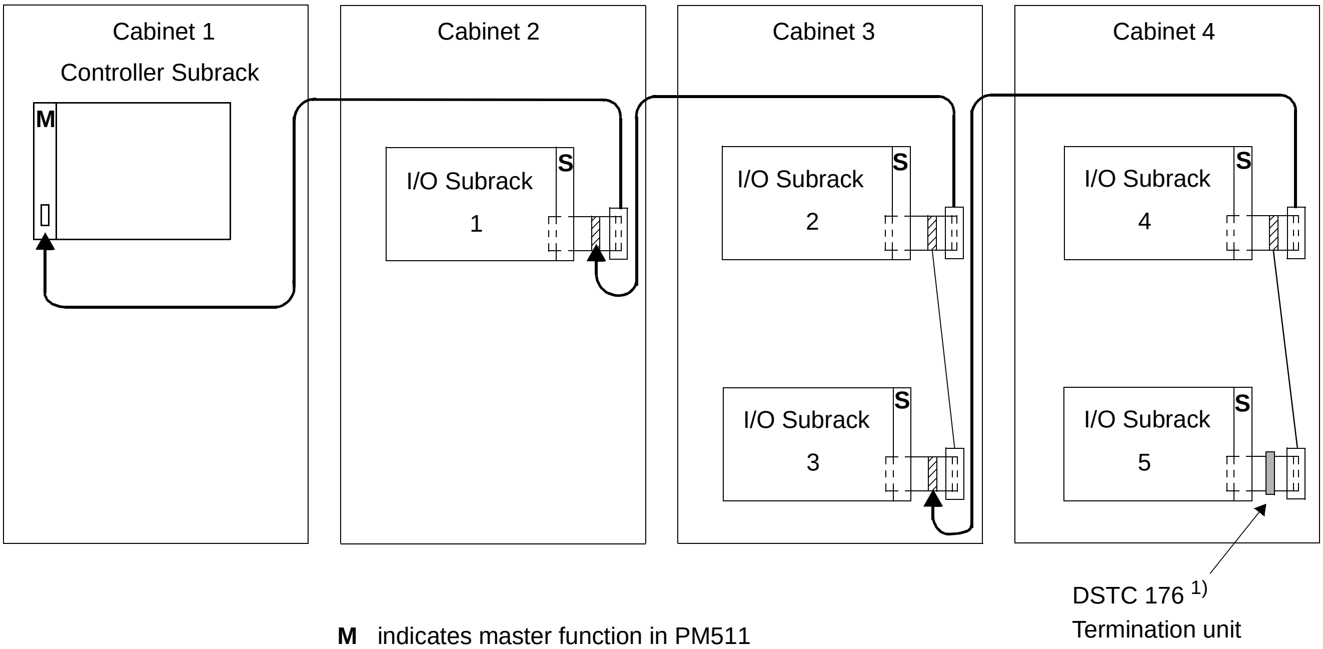
- Single CPU configuration
- Redundant CPU configuration with single bus cable and extenders.
- Redundant CPU configuration with redundant bus cables and extenders.

DSBC 174 should be placed in the last position of the I/O subrack if single bus extender is used and in the last and second last if redundant bus extenders are used.

DSBC 174 could also be used as a replacement for DSBC 173A but must in this case be strapped accordingly to be fully compatible with DSBC 173A.

The following functions are supported:

- Bus clock signals, generated for the backplane bus on the I/O subrack.
- Supervision of functions such as fans and redundant regulators.
- LED’s on the DSBC 174 front, indicating status of the I/O subrack.



M indicates master function in PM511
Connection on module front

S indicates slave module DSBC 174
Connection from behind

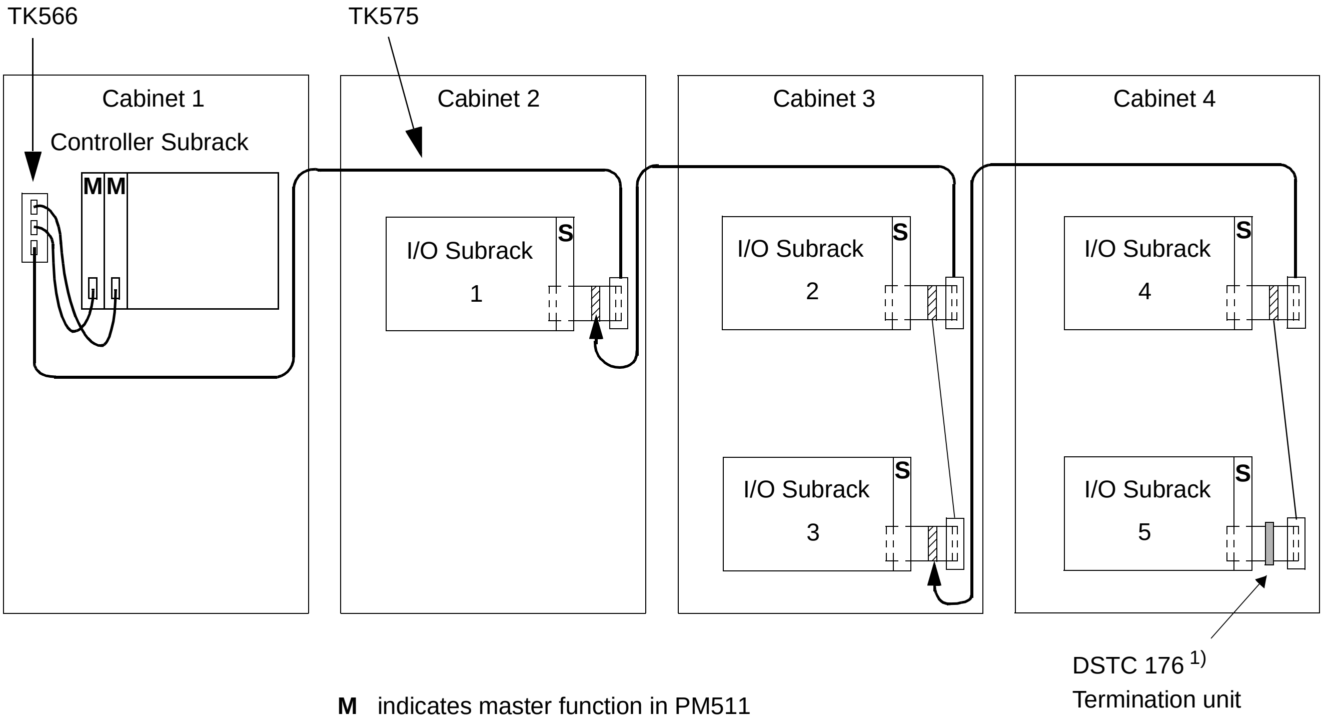
1) DSTC 176 is a plug unit (delivered with first I/O subrack) located on the right side of the last I/O subrack in the chain

Figure 3-1. Example of How to Connect a Single PM511 to DSBC 174 in a RE Cabinet

The bus extender (see Figure 3-1) consists of:

- One master interface on PM511
- One to five slave boards, DSBC 174, each located in a separate I/O subrack
- Standard cables which connect between the PM511and the first DSBC 174, and between the I/O subracks.

The maximum length of the bus extension is 12 m, that is, the total length of the bus cables used.



M indicates master function in PM511
Connection on module front

S indicates slave module DSBC 174
Connection from behind

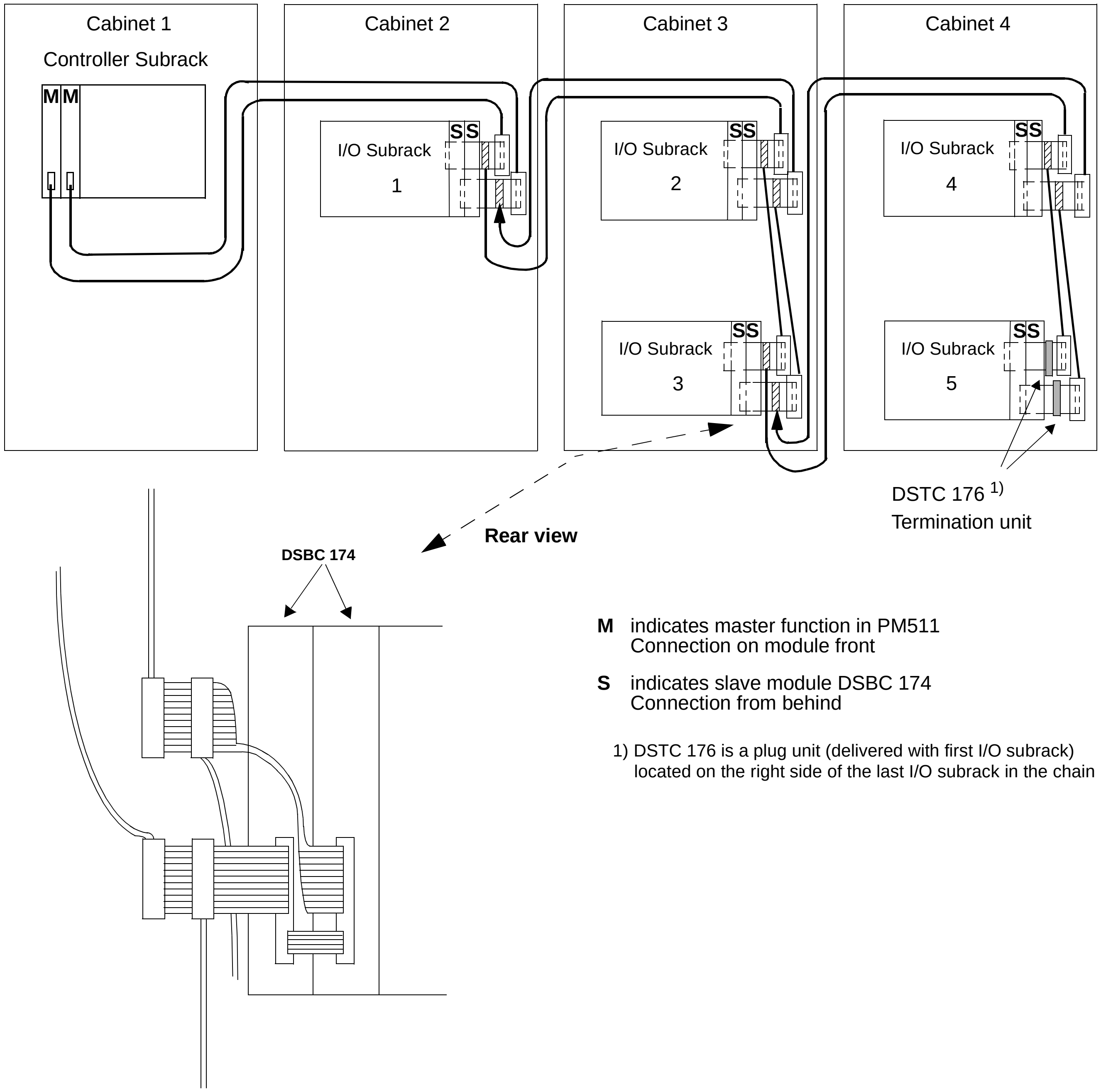
1) DSTC 176 is a plug unit (delivered with first I/O subrack) located on the right side of the last I/O subrack in the chain

Figure 3-2. Example of How to Connect Redundant PM511´s to DSBC 174 in a RE Cabinet

The bus extender (see Figure 3-2) consists of:

- Two master interface on PM511's
- One TK566 interconnector to allow the two PM511 to share cable and bus extension.
- One to five slave boards, DSBC 174, each located in a separate I/O subrack.
- Standard cables which connect the two PM51s via TK566 to the first DSBC 174, and between the I/O subracks.

The maximum length of the bus extension is 12 m, that is, the total length of the bus cables used.



M indicates master function in PM511
Connection on module front

S indicates slave module DSBC 174
Connection from behind

1) DSTC 176 is a plug unit (delivered with first I/O subrack) located on the right side of the last I/O subrack in the chain

Figure 3-3. Example of How to Connect Redundant PM511´s to Redundant DSBC 174's in a RE Cabinet

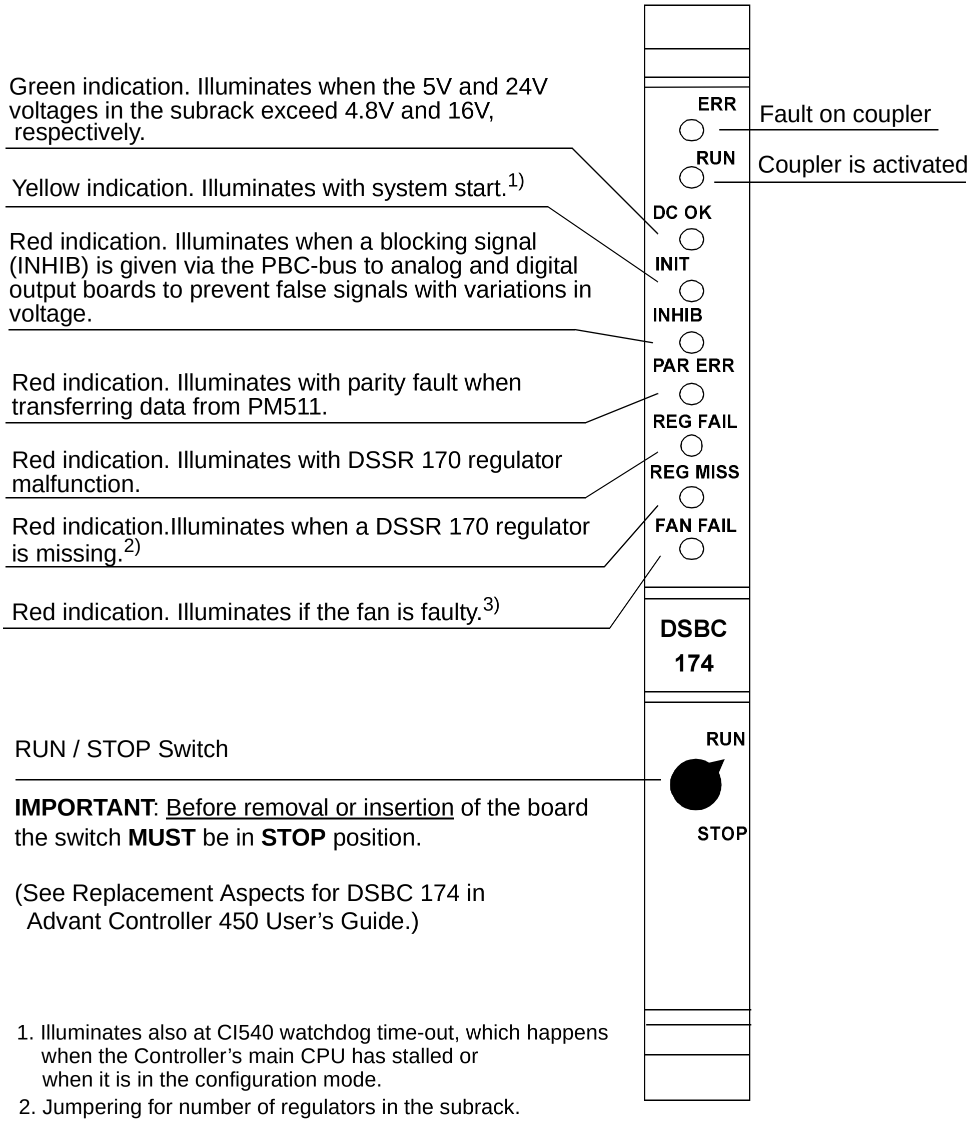
The bus extender (see Figure 3-3) consists of:

- Two master interface on PM511
- Two to ten slave boards, DSBC 174, two and two located in a separate I/O subrack
- Standard cables which connect between the PM511’s and the first two DSBC 174, and between the I/O subracks.

The maximum length of the bus extension is 12 m, that is, the total length of the bus cables used.

3.2 Front Panels

Figure 3-4 show the front panel of the bus extender board DSBC 174



Fault on coupler

Coupler is activated

Green indication. Illuminates when the 5V and 24V voltages in the subrack exceed 4.8V and 16V, respectively.

Yellow indication. Illuminates with system start.1)

Red indication. Illuminates when a blocking signal (INHIB) is given via the PBC-bus to analog and digital output boards to prevent false signals with variations in voltage.

Red indication. Illuminates with parity fault when transferring data from PM511.

Red indication. Illuminates with DSSR 170 regulator malfunction.

Red indication.Illuminates when a DSSR 170 regulator is missing.2)

Red indication. Illuminates if the fan is faulty.3)

RUN / STOP Switch

IMPORTANT: Before removal or insertion of the board the switch **MUST** be in **STOP** position.

(See Replacement Aspects for DSBC 174 in Advant Controller 450 User’s Guide.)

1. Illuminates also at CI540 watchdog time-out, which happens when the Controller’s main CPU has stalled or when it is in the configuration mode.
2. Jumpering for number of regulators in the subrack. See DSSR 170.
3. The I/O subrack normally has no fan.

Figure 3-4. Front Panel of the Bus Extender Board DSBC 174

3.3 Jumpering

There are no jumpers on PM511. The bus extender board DSBC 174's jumpers are shown in the Table 3-1 and Figure 3-5 below.

Table 3-1. Jumpering of the Bus Extender Board DSBC 174

Jumper Function	Jumper Groups for DSBC 174
Bus Extender Address	S1
Production Test	S4
DSBC 174/DSBC 173A Mode	S3

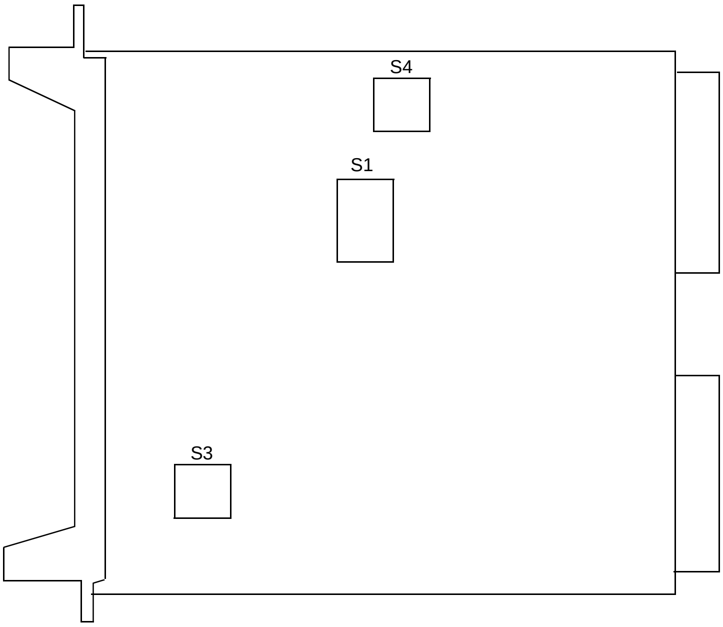


Figure 3-5. Bus Extender Board DSBC 174, Location of Jumper Groups

3.3.1 Bus Extender Address Jumper

The bus extender address jumper is used to give each of the I/O racks connected to an Advant Controller 450 a unique address. The most significant address bit (7) is used to distinguish between right and left bus extender when redundant bus extenders are used. Five address bits (6-2) are used to indicate the I/O rack number. Address bits 1 and 0 are not used.

Table 3-2. Examples of Bus Extender Address Jumpering on DSBC 174

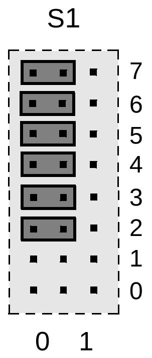
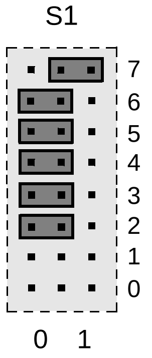
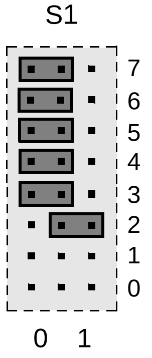
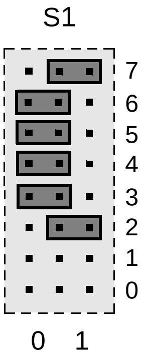
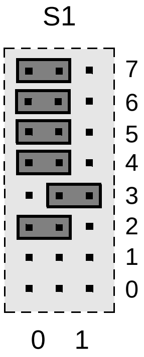
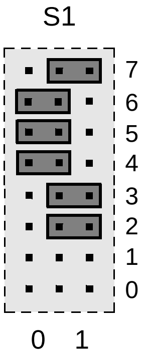
Function	DSBC 174
Single bus extender in first I/O rack or left bus extender of redundant pair in first I/O rack	
Right bus extender of redundant pair in first I/O rack	
Single bus extender in second I/O rack or left bus extender of redundant pair in second I/O rack	

Table 3-2. Examples of Bus Extender Address Jumpering on DSBC 174 (Continued)

Function	DSBC 174
Right bus extender of redundant pair in second I/O rack	
Single bus extender in third I/O rack or left bus extender of redundant pair in third I/O rack	
Right bus extender of redundant pair in forth I/O rack	

3.3.2 Production Test Jumper

The jumper group S4 on the bus extender board DSBC 174 is used for production test purposes only. It shall always be set according to Figure 3-6.

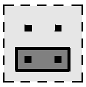
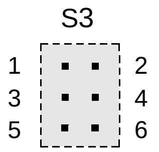
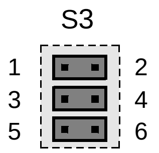


Figure 3-6. Production Test Jumper S4 on DSBC 174

3.3.3 Bus Extender Mode Jumper

The jumper group S3 on the bus extender board DSBC 174 is used to select operation mode. If the board should be used in DSBC 173A mode as a direct replacement for a DSBC 173A all three jumper positions should be strapped. In other cases all three should be left empty. When the board is strapped for DSBC 173A compatibility the bus extender address jumpers have no meaning. See Table 3-3.

Table 3-3. Bus Extender Mode Jumper on DSBC 174

Function	DSBC 174
DSBC 174 Mode (Normal position)	
DSBC 173A Mode (Used as direct replacement for DSBC 173A)	

3.4 Optical Bus Extension

3.4.1 General Description

The optical bus extension is a complement to the normal S100 I/O bus extension used in the products Advant Controller 450.

NOTE

You can not use this optical bus extension in Advant Controller 410.

With the optical bus extension I/O subracks can be placed up to 500 meters from the central subrack of the controllers/process stations.

The optical bus extension is a serial link designed for point-to-point connection (multidrop configuration is not possible) of up to 5 I/O subracks in the far-side. Between the I/O subracks in the far side, the normal bus extension is used.

The optical bus extension consists of two modems, TC560V1 in the near-side and TC561V1 in the far- side. Between the modems there is a serial link containing two optical fibres, one for sending and one for receiving signals.

NOTE

Together with PM511 and DSBC 174, TC560V1 and TC561V1 (and not TC560 and TC561) has to be used as they support redundant configurations.

In the near-side up to 5 “nodes”, I/O subracks with DSBC 174 or TC560V1, can be connected with the normal bus extension.

All supervision signals connected to the DSBC 174 in the far-side are transferred via the optical bus extension to PM511.

The modems can be powered by two independent 24V d.c. supplies internally connected to each other via diodes.

Two additional Supervision Signals (FA, FB) are generated internally from two 24 V Digital Inputs on the far-side, and transferred to two 24 V Digital Outputs on the near-side. In this way, a supervision of the power supply voltages on the far-side can be carried out on the near-side.

3.4.2 Bus Extension Configuration for S100 I/O Subracks

3.4.2.1 Bus Extension with Single Bus Extender

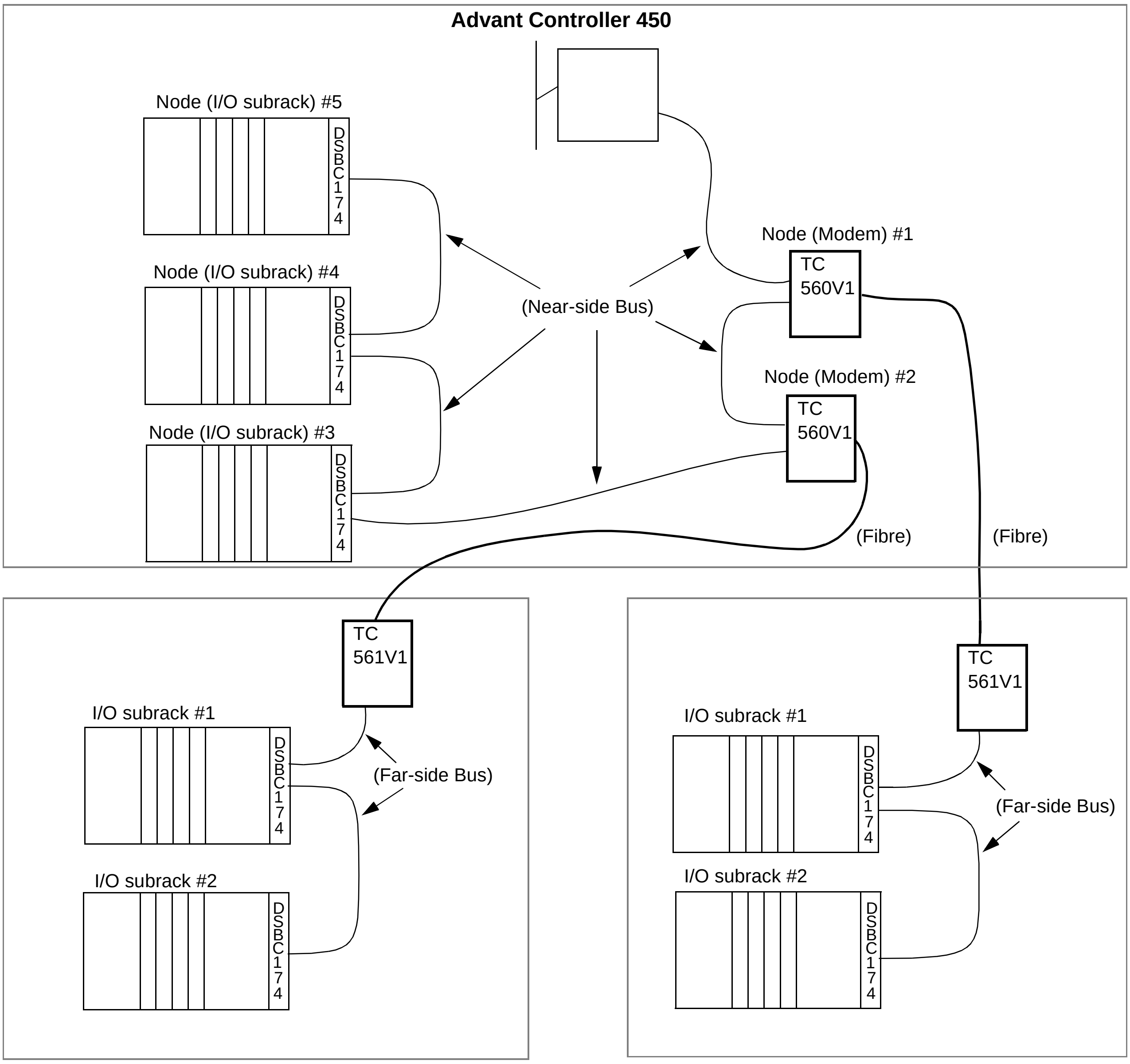


Figure 3-7. Example of Optical Bus Extension with Advant Controller 450

Advant Controller 450 and I/O Subracks chained together with Bus Extension Cables **and** Optical Bus Extensions.

3.4.2.2 Bus Extension with Redundant Bus Extenders

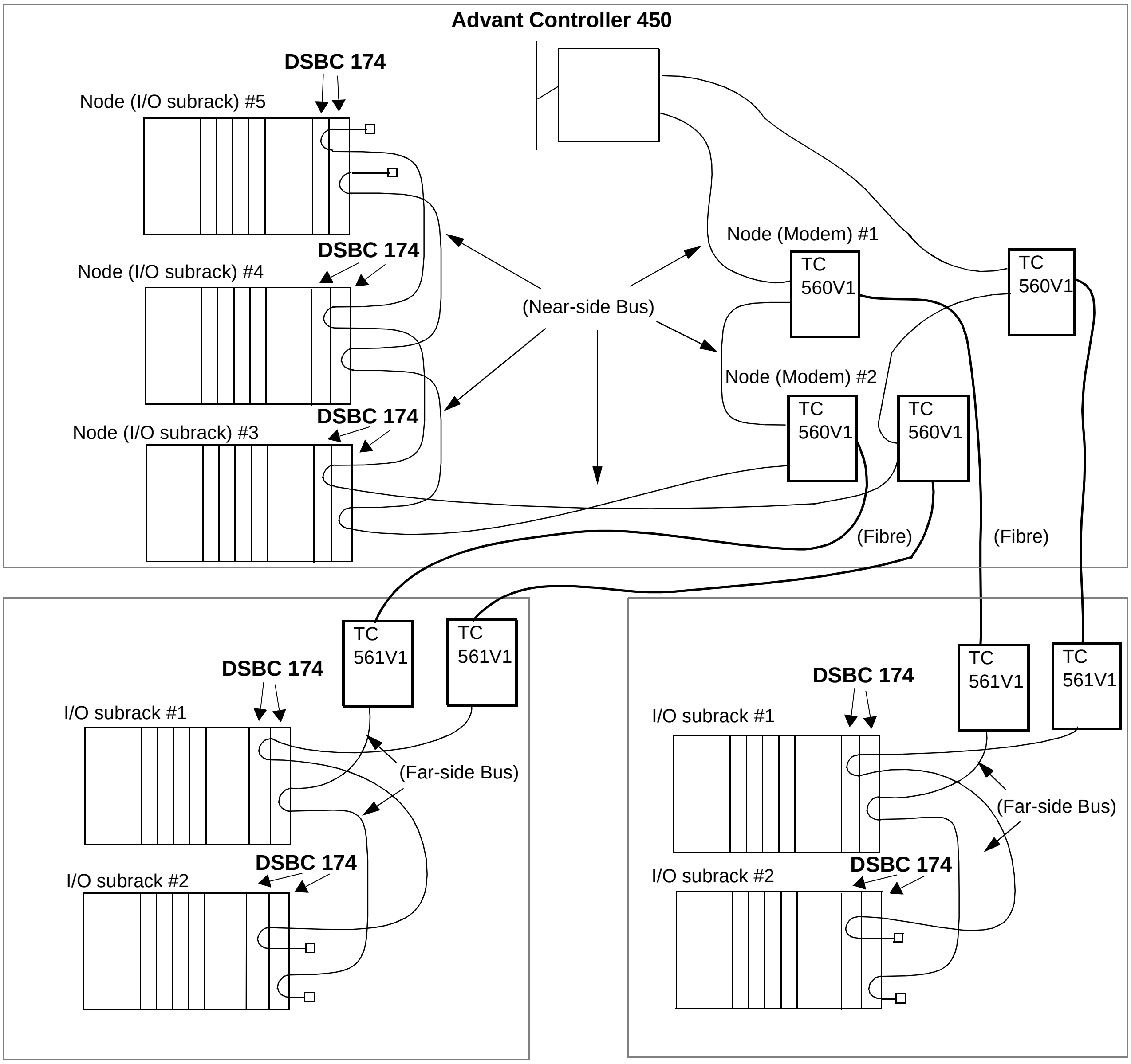


Figure 3-8. Example of Optical Bus Extension with Advant Controller 450 and Redundant Bus Extenders

Advant Controller 450 and I/O Subracks with redundant bus extenders chained together with Bus Extension Cables **and** Optical Bus Extensions.

3.4.2.3 Components

The following components are tied to the optical bus extension:

TC560V1	Modem	(Near-side)
TC561V1	Modem	(Far-side)
TK560	Interconnector	(Near-side)
TX560	Terminator	(Near-side)
TK580	Cable Assembly	(Near-side; 1,8m)
TK580V007	Cable Assembly	(Near-side; 0,7m)
TK575	Cable Assembly	(Near-side, Far-side; 3,5m)

3.4.2.4 Boundary Conditions

Boundary Conditions (See Figure 3-9 - Figure 3-10)

Near-side Bus

- Max total bus cable length: 12 m
- Max no. of DSBC 174 and TC560V1: 5
- TK560 as well as TX560 shall be mounted on front of TC560V1. (See also Figure 3-14)[1].
- In case of maintenance, TK560 as well as TX560 may be removed from TC560V1.
- It is recommended that any DSBC 174 on the near-side shall be connected *after* the TC560V1s on the bus (see Figure 3-10).
- The above recommendation implies that if any DSBC 174 is connected on the near-side, the Terminator DSTC 176 applies instead of TX560.
- The connection between PM511 and TK560 (or TX560) takes place by means of TK580.
- The connection between TK560 and DSBC 174 takes place by means of TK575.

Serial Link

- Medium: Optical Fibre (dual)
- Type: 62,5/125 µm (50/125 µm also possible)
- Connection: Bayonet ST Connector Receiptables (on TC560V1/TC561V1)
- Max. length: 500 m

Far-side Bus

- Max total bus cable length: 12 m
- Max no. of DSBC 174: 5
- The connection between TC561V1 and DSBC 174 takes place by means of TK575.

---

[1] Due to this, the clearance distance from the front of TC560V1 shall be not less than 90 mm.

3.4.2.5 Supply Voltage Status Transfer

Supervision of the power supply voltages on the far-side (24VA and 24VB) is done by connecting 24VA and 24VB through a Diode/Voting Unit (either DSSS 170 or DSSS 171) to the inputs FA and FB of TC561V1, and the outputs FA and FB of TC560V1 on the near-side to either TC520. If more than one optical bus extension are connected to the same PM511, the outputs from the TC560V1s may be connected in parallel in a wired-or configuration (see also Figure 3-11 and Figure 3-13).

Power Status (See Figure 3-11).

Near-side Outputs

- 24V Digital outputs, 2 channels (non-isolated) FA and FB
- Short-circuit proof; min. load 2,2 kOhm (corresponding to max. 10 mA).
- Connection: 3-pin jackable plints (cable area = 0.5 - 2,0 mm^2)

NOTE
Each Near-side output is controlled by a corresponding Far-side input.

NOTE
Near-sid outputs may be chained together in a “wired-or” configuration.

Far-side Inputs

- 24V Digital inputs, 2 channels (non-isolated) FA and FB
- Input switching level: 13.0V +/- 1.0V
- Connection: 3-pin jackable plints (cable area = 0.5 - 2,0 mm^2).

When employing either the Diode Unit DSSS 170 or the Voting Unit DSSS 171, (see also Section 3.4.2.6 Powering the Modems), the corresponding Status Connections are:

Table 3-4. Status Connections

STATUS	TC560V1/TC561V1	DSSS 170	DSSS 171/DSBB 188
Sup. 24VA	X1+X2: 1 (FA)	X3: 14 (24VFAILA)	X6+X7: 1 (FAIL24V_A)
Sup. 0VA	X1+X2: 3 (0V)	X3: 5	X1: b (0V_A)
Sup. 24VB	X1+X2: 2 (FB)	X3: 16 (24VFAILB)	X6+X7: 2 (FAIL24V_B)
Sup. 0VB	X1+X2: 3 (0V)	X3: 6	X2: b (0V_B)

3.4.2.6 Powering the Modems

Power requirements of TC560V1 or TC561V1 (See Figure 3-12):

- Supply: +24V d.c.
- Voltage range: 18 - 30V.
- Can be connected to two independent power sources (internally united by means of diodes).
- Power consumption, Near-side: 5.6W (Digital output channels: NOT included)
- Power consumption, Far-side: 6.6W (Digital input channels: negligible)
- Connection: 2-pin jackable plints (cable area = 0.5 - 2,0 mm^2).

NOTE

For supervision reasons, the +24V Supply on the near-side shall correspond to that of the Central Subrack, and the +24V Supply on the far-side shall correspond to that of the I/O Subrack(s). This implies that when employing either the Diode Unit DSSS 170 or Voting Unit DSSS 171, (see Section 3.4.2.5 Supply Voltage Status Transfer), the corresponding Power Connections are:

Table 3-5. Power Connections

POWER	TC560V1/TC561V1	DSSS 170	DSSS 171/DSBB 188
24VA	X1: 5 (24V)	X3: 1	X1: a (24V_A)
0VA	X1: 6 (0V)	X3: 5	X1: b (0V_A)
24VB	X2: 5 (24V)	X3: 3	X2: a (24V_B)
0VB	X2: 6 (0V)	X3: 6	X2: b (0V_B)

3.4.2.7 LED Indications

LED Indications on TC560V1 or TC561V1(See Figure 3-13)

- RF = Remote Failure (Red)[1)]
- P = +5V_OK (Green)
- INH = INHIBIT (Yellow)
- INIT = INIT (Yellow)
- TX = Transmission (Yellow)
- RX = Reception (Yellow).

NOTE

The same LED Indicators are found on Near-side (TC560V1) as well as Far-side (TC561V1).

---

[1] This is a sum error indication for all five Remote Status Signals (REGMISS, REGFAIL, FANFAIL, FA, FB),

3.4.2.8 Use and Maintenance Guidelines

NOTE

In case of maintenance, such as replacement of a unit (TC560V1 or TC561V1) or replacement of Optical Fibre, ***it is recommended to disconnect the power of the relevant unit before carrying out any such maintenance.***
See Replacement Aspects for TC560V1 or TC561V1 in Advant Controller 450 User’s Guide.

This implies that if TK560 or TX560 is to be disconnected from (or connected to) TC560V1, this should be done only after the power of TC560V1 has been disconnected.

If maintenance of a far-end unit (TC561V1) takes place, this may be done without disconnecting the power of the near-end unit (TC560V1), and vice versa.

If the power of a TC560V1 is to be disconnected, then the Status-signals (FA, FB) of that unit must also be disconnected, since the two 24 V Digital Outputs only work properly with a 24 V Supply connected.

CAUTION

Never disconnect an Optical Fibre of a unit under running condition, since this may cause disturbances on the on-going data traffic between the CPU and the I/O devices.

CAUTION

When using Cable Assembly TK575, always make sure that Cable Lug M3 has a good ground connection to the relevant subrack.

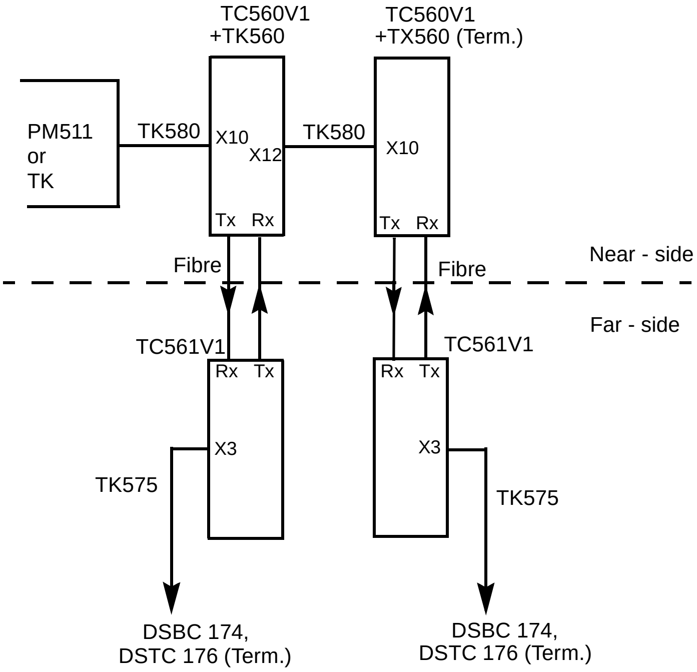


Figure 3-9. Advant Controller 450 with TC560V1 on Near-side

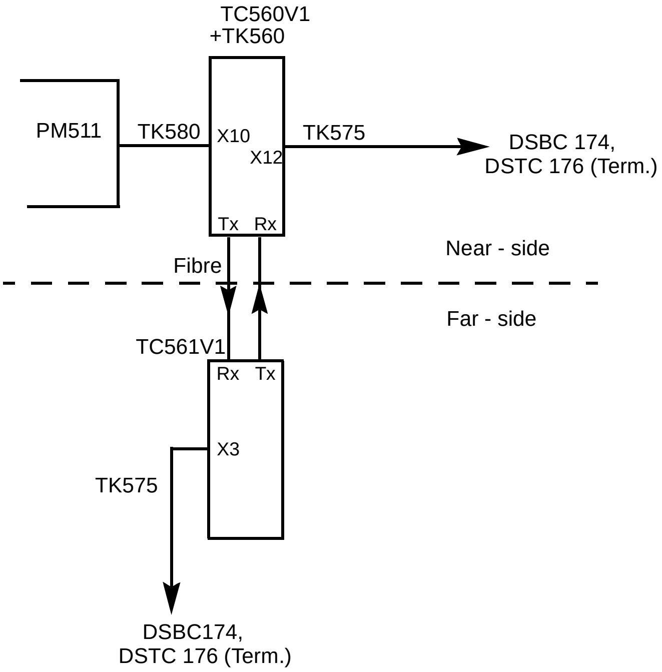


Figure 3-10. Advant Controller 450 with both TC560V1 and I/O Subracks on Near-side

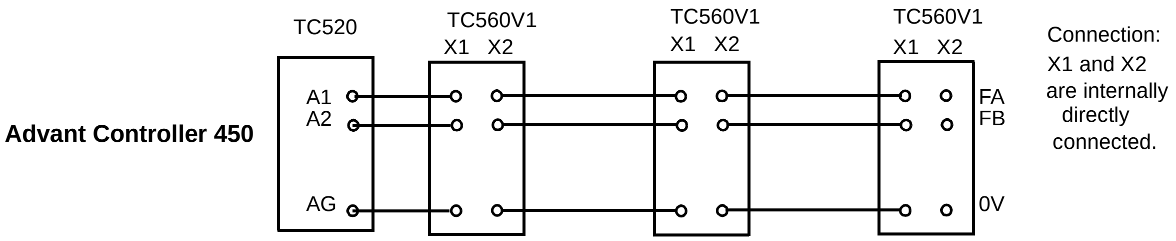


Figure 3-11. Connection of Supervision Signals from TC560V1

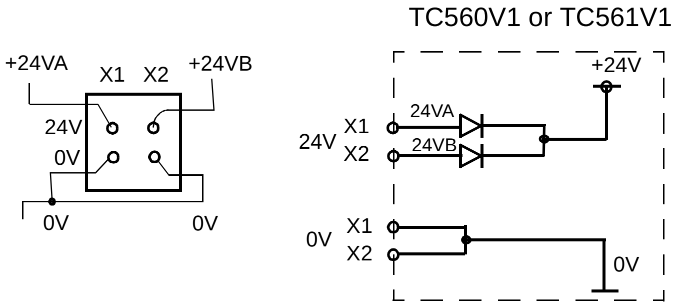


Figure 3-12. Connection of Supply Voltage to the Modems

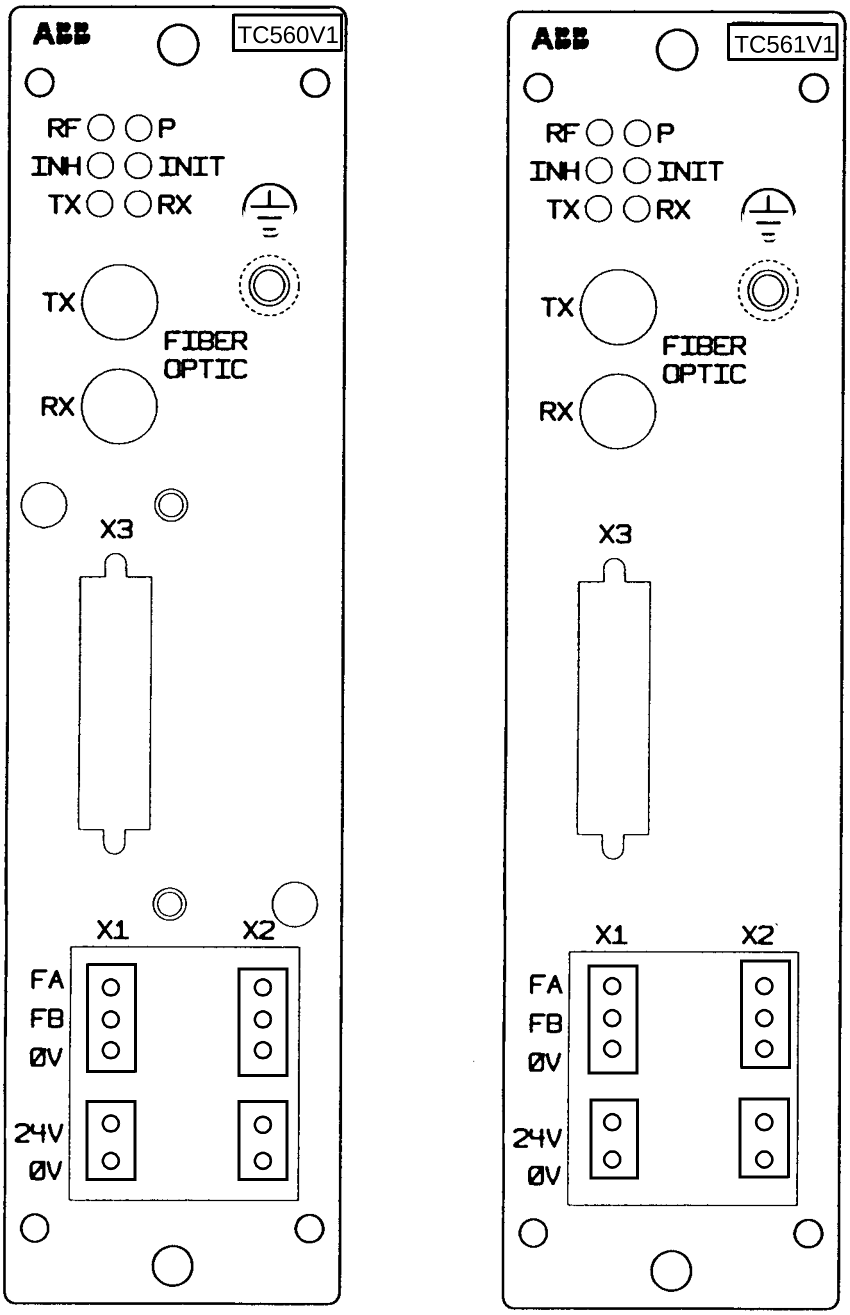


Figure 3-13. Front Plates of TC560V1 and TC561V1

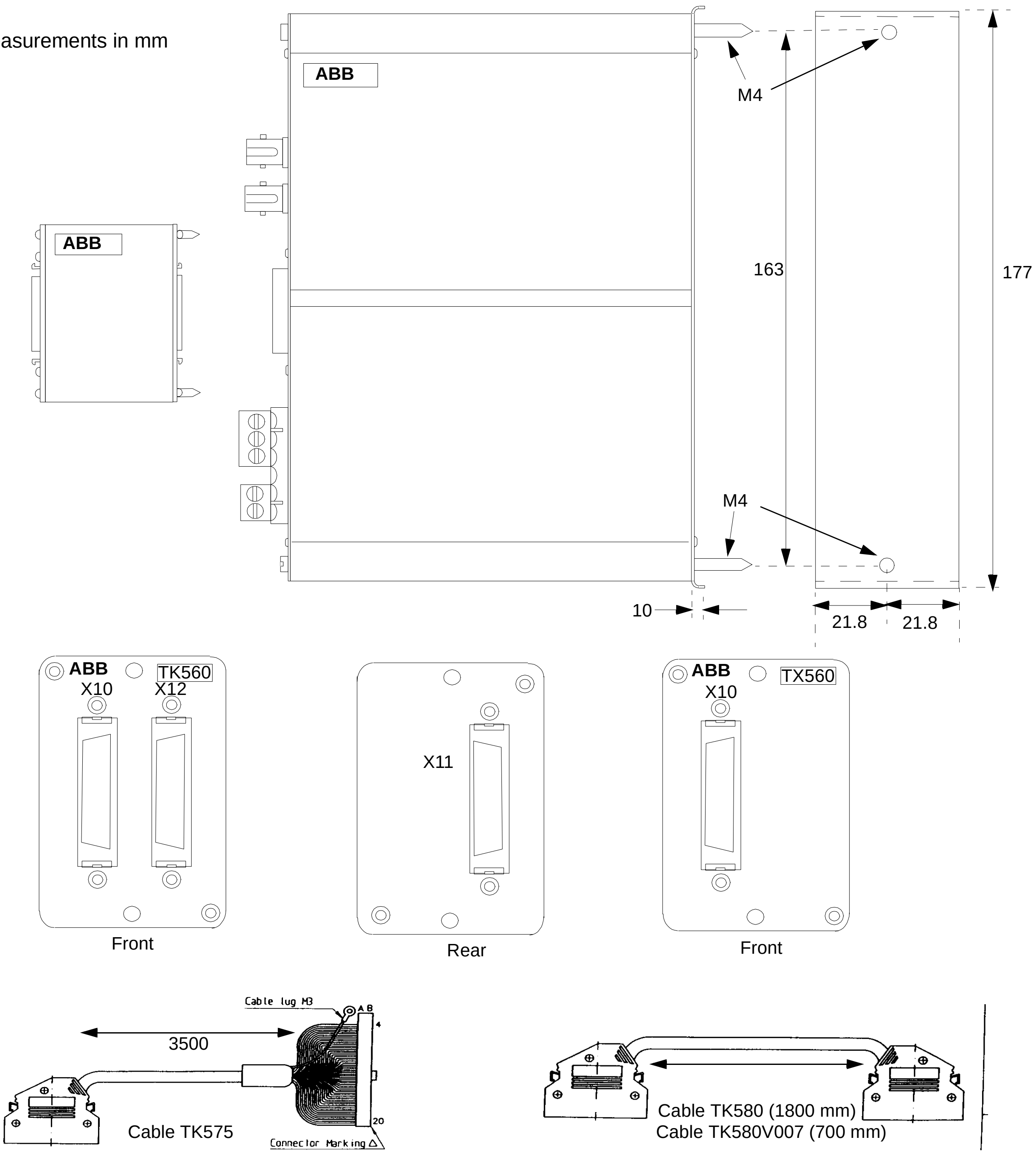

All measurements in mm

Figure 3-14. Mechanics

Chapter 4 I/O Subrack

4.1 General

The I/O subrack is fitted with guide bars for circuit boards and other plug-in units. A locking bar at the upper front edge fixes the units when you insert them. You connect each board to the backplane of the I/O subrack. The connection units are connected to the I/O boards via standard cables and are normally mounted in the backplane of the cabinet.

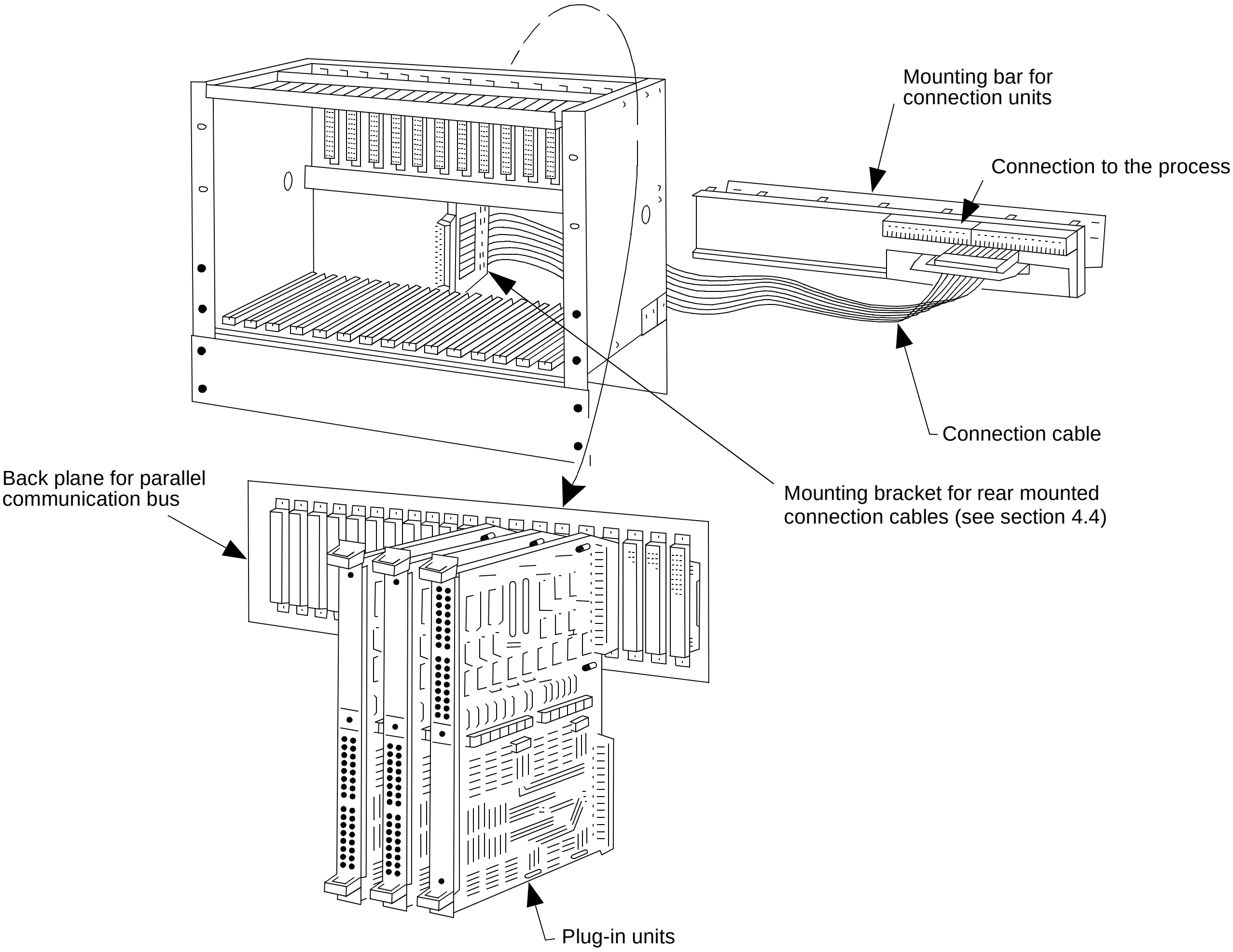

Mounting bar for connection units
Connection to the process
Connection cable
Back plane for parallel communication bus
Mounting bracket for rear mounted connection cables (see section 4.4)
Plug-in units

Figure 4-1. I/O Subrack Configuration, connection cables rear mounted

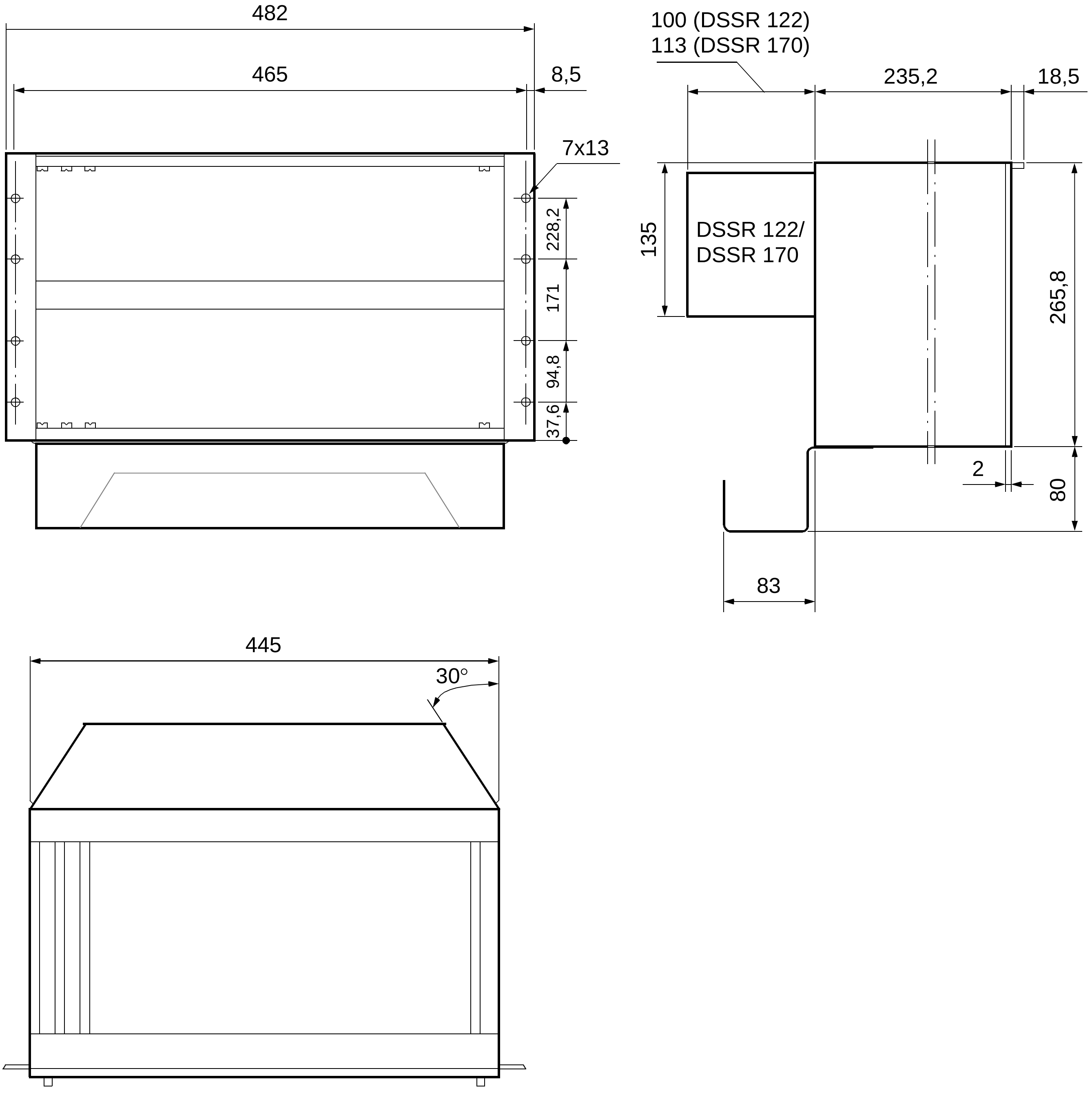


Figure 4-2. I/O Subrack, Dimension Print (in mm)

4.2 I/O Subrack

The general I/O subrack can contain up to 20 I/O boards and a bus extender board DSBC 173A, which has both voltage supervision and bus extender functions. Connect the I/O subrack to the Controller and to other I/O subracks via the bus extender boards. See Figure 4-3.

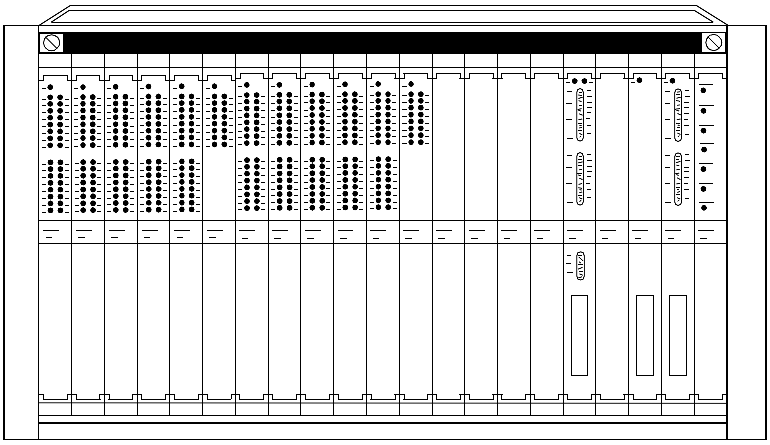


Figure 4-3. Front of I/O Subrack with Bus Extender Board to the Far Right

This I/O subrack is available in two basic versions:

- With single 5 V-regulator unit or
- With redundant 5 V-regulator units.

In its basic form, with a single 5 V-regulator unit, the I/O subrack consists of the following:

- Subrack DSRF 182/DSRF 197, which includes,
  - Subrack DSRF 114 and
  - Backplane DSBB 172A.
- Voltage regulator unit DSSR 122.
- Bus extender board DSBC 173A, with connection cable and plug-in termination unit DSTD 176 [1].

In its basic form, with redundant 5 V-regulator units, the I/O subrack consists of the following:

- Subrack DSRF 187/DSRF 200, which includes,
  - Subrack DSRF 114,
  - Backplane DSBB 174 and
  - Power bus plane DSBB 188.
- Power voting unit DSSS 171,
- Voltage regulator unit DSSR 170 (three units),
- Bus extender board DSBC 173A, with cable and plug-in termination unit DSTD 176 [1].

---

[1] Supplied with the first I/O subrack and installed in the last I/O subrack.

4.3 I/O Subrack for Advant Controller 410

In the I/O subrack for Advant Controller 410, the Controller box occupies the first six slots in the subrack. The other 15 slots are available for the I/O boards. See Figure 4-4.

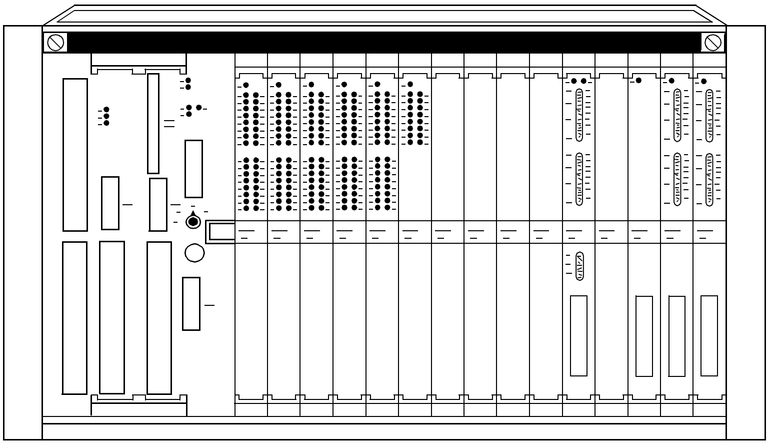


Figure 4-4. Front of I/O Subrack for Advant Controller 410

The I/O subrack for Advant Controller 410 is available in two basic versions:

- With a single 5 V-regulator unit or
- With redundant 5 V-regulator units.

In its basic form, with a single 5 V-regulator unit, the I/O subrack for Advant Controller 410 consists of the following:

- Subrack DSRF 185/DSRF 198, which includes,
  - Subrack DSRF 114 and
  - Backplane DSBB 174.
- Voltage regulator unit DSSR 122.

In its basic form, with redundant 5 V-regulator units, the I/O subrack for Advant Controller 410 consists of the following:

- Subrack DSRF 186/DSRF 199, which includes,
  - Subrack DSRF 114,
  - Backplane DSBB 174 and
  - Power bus plane DSBB 188.
- Power voting unit DSSS 171
- Voltage regulator unit DSSR 170 (three units).

4.4 Different mounting of connection cables

An alternative subrack design is introduced. A newer mounting alternative differs from earlier in the way the cables are mounted to the subrack. New cables (DSTK 220 - DSTK 234) can be mounted from the rear side without having to remove any card. Earlier the cable had to be mounted from the front side of the original rack. **However older cables cannot be mounted with new subracks (DSFR 197 - DSRF 200)**.

The only difference in design is that the new cables have a mounting clamp at the rack side. If you remove the bracket clamp from the cable it can be used to the old rack.

4.5 Voltage Regulators

4.5.1 Voltage Regulator Unit DSSR 122

You can install the voltage regulator unit DSSR 122 on the rear of the I/O subrack for the supply of 5 V. It converts 24 V d.c. to 5 V d.c. Fix the unit to the I/O subrack with screws.

The input to the regulator is protected with a tube fuse, F1. The output, which is galvanically connected to the input, is current limited. The unit is provided with overvoltage protection. The voltage regulator unit draws constant power down to approximately 14 V input voltage.

Figure 4-5 shows a DSSR 122 mounted on an I/O subrack.

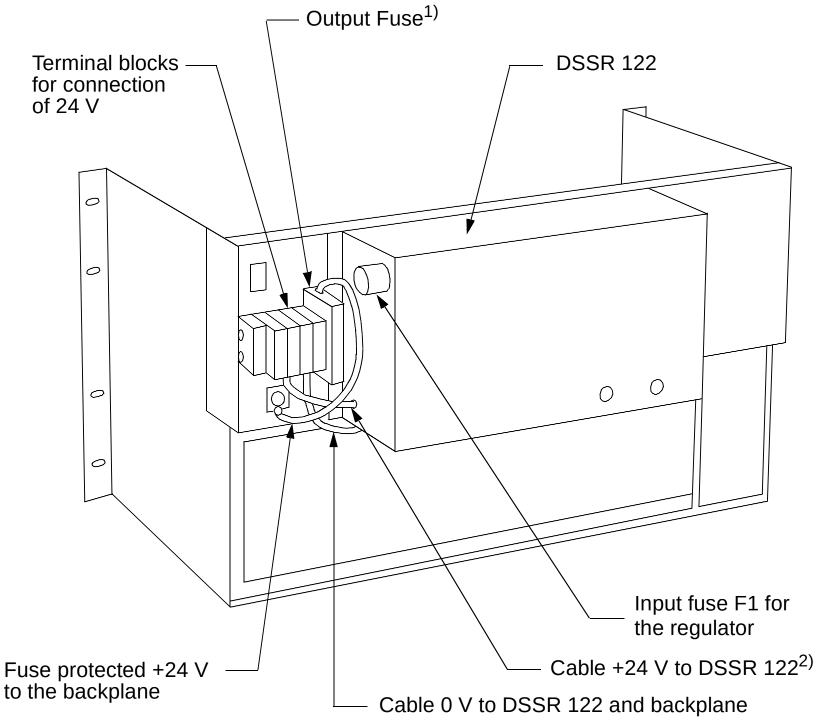

Output Fuse1)
Terminal blocks for connection of 24 V
DSSR 122
Input fuse F1 for the regulator
Fuse protected +24 V to the backplane
Cable +24 V to DSSR 1222)
Cable 0 V to DSSR 122 and backplane

Figure 4-5. Voltage Regulator Unit DSSR 122 Mounted on an I/O Subrack

1) Fuse 10 A (miniature, 5 x 20 mm, fast) for +24 V - PBC - bus.
2) The cable from DSSR 122 is marked with “124” and should be connected to the terminal block X1 11/1.

Table 4-1 contains key data for the voltage regulator unit DSSR 122.

Table 4-1. Technical Data for the Voltage Regulator Unit DSSR 122

Data	**DSSR 122**
Input voltage	24 V d.c (24 ± 6 V)
Maximum input power	280 W
Maximum input power at overload	340 W
Output voltage	5.2 V ± 0.2 V
Maximum load	40 A
Efficiency	Minimum 75%
Conversion factor: (@ U_{in} = 24 V, U_{out} = 5.2 V)	$I_{out}/I_{in} \cong 3.5$
Fuse F1 (midget, 10 x 38 mm, fast)	20 A
Width x depth x height	263 x 88 x 138 mm

Figure 4-6 is a block diagram for DSSR 122.

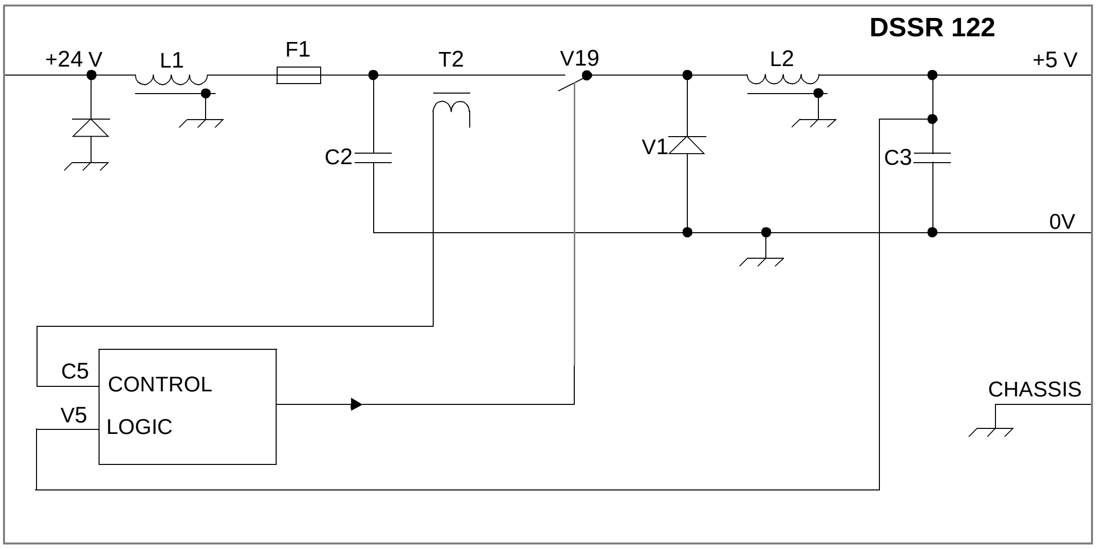


Figure 4-6. Block Diagram for DSSR 122

4.5.2 Power Voting Unit DSSS 171 and Voltage Regulator Unit DSSR 170

The DSSS 171 power voting unit is used for connecting dual DC 24V (24V_A, 24V_B) supply to a single 24V power bus. The voltage regulator unit DSSR 170 converts 24 V d.c. to 5 V d.c. voltage.

DSSS 171 is housed in a heatsink case permitting natural or forced air coolant. If the subrack is powered from a single DC 24V network, the DSSS 171 can be omitted. The DSSS 171 contains the 24V power circuits and a supervisory logic circuitry indicating and signalling status for the power supply circuits 24V_A, 24V_B, also indicating a blown fuse for the common voltage output to the subrack PBC - bus.

DSSR 170 is used in systems with redundant power converters. The redundancy is obtained by installing one extra regulator unit, in addition to the normal requirement to give (n+1) redundancy. Standard configuration is one DSSS 171 and three DSSR 170. The DSSS 171 is mounted in the leftmost position on the power bus plane DSBB 188. The regulators are plugged into the remaining slots on DSBB 188, where one of them must be plugged into the rightmost position. The power bus plane DSBB 188 is mounted on the rear of the I/O subrack.

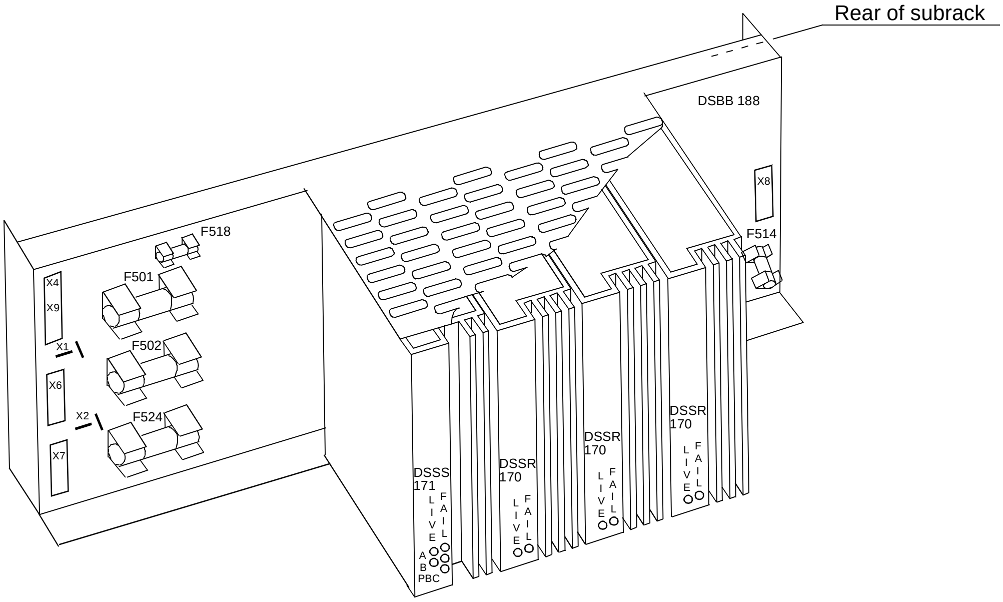


Figure 4-7. One DSSS 171 and Three DSSR 170 Units Mounted on a DSBB 188

The power bus plane DSBB 188 contains a supply bus, bus for supervision of +24 V supply and the regulator function (malfunction or missing), filter and fuses for +24 V supply.

You can exchange a voltage regulator unit DSSR 170 in a live system with (n+1) redundancy without disturbing the system operation. When replacing a regulator, you must place a new unit in the same position as the one which it replaces. The upper fixing screw has a switching function; tighten it to start the regulator.

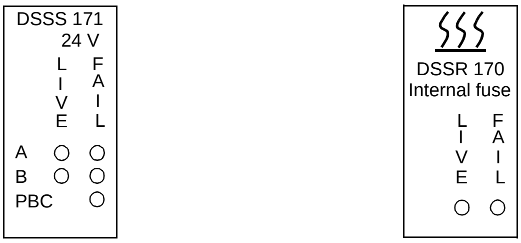


Figure 4-8. Front Plates of DSSS 171 and DSSR 170

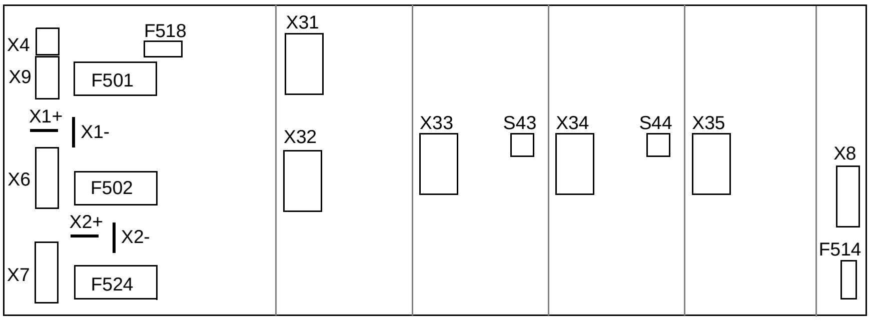


Figure 4-9. Power Bus Plane DSBB 188, Location of Jumper Groups and Connectors

For supervision of a missing regulator, jumper the signal REGMISS-N at the vacant places in DSBB 188 to avoid incorrect signaling that a regulator is missing. Each slot for redundant regulators has a corresponding jumper group, S43 - S44, which should be jumpered according to Figure 4-10. The rightmost slot has no corresponding jumper group and must therefor not be vacant. Figure 4-9 shows the location of the jumper groups as well as the connectors. See also Figure 4-11.

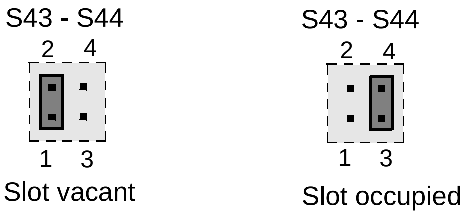


Figure 4-10. Jumpering of S43 and S44

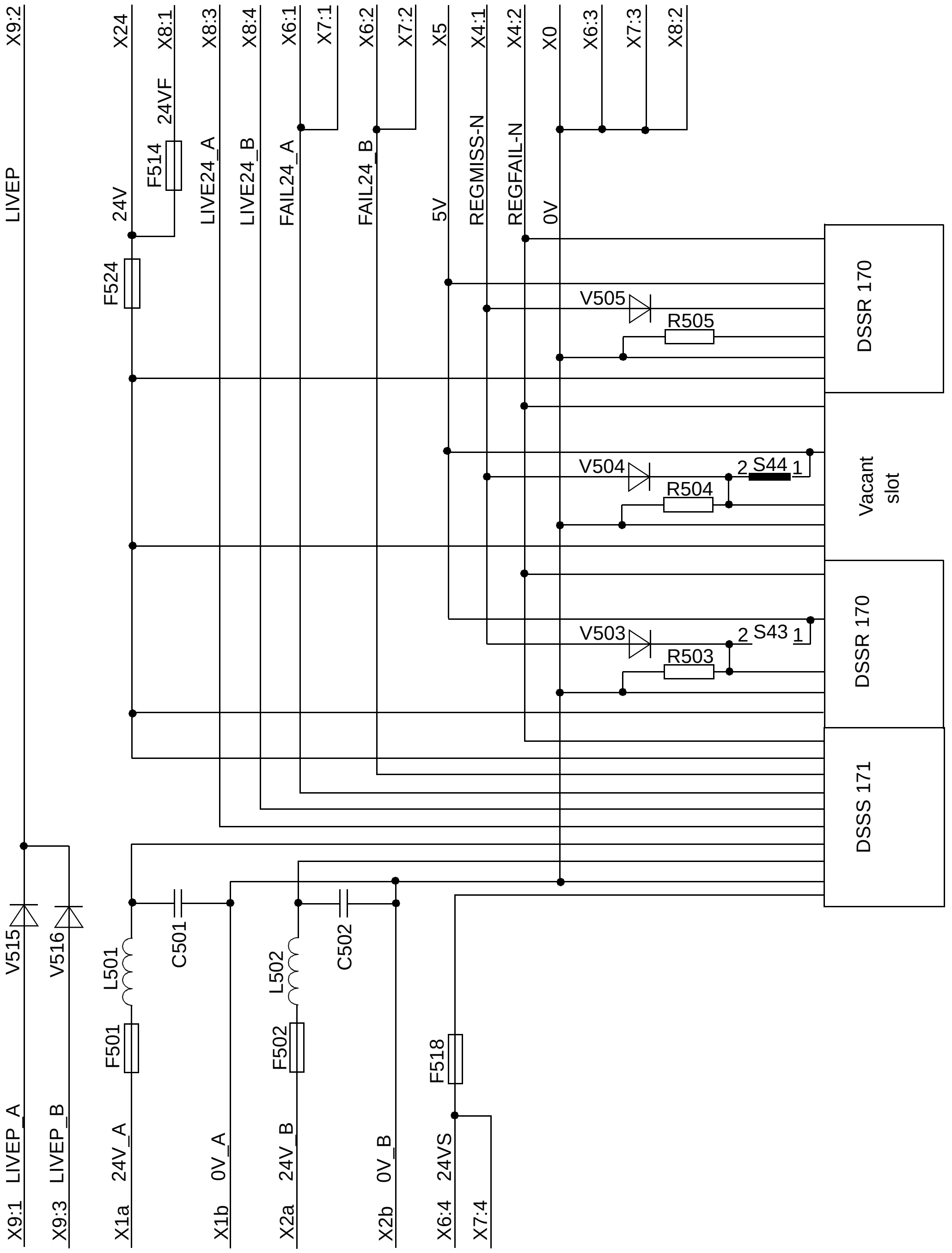


Figure 4-11. Power Bus Plane DSBB 188 with a DSSS 171 and Two DSSR 170 Connected

The DSSR 170 is supervised by a internal discriminator, “WATCH”, which:

- Blocks the regulator at undervoltage (< +16 V),
- Signals function fault REGFAIL-N and
- Indicates function status (LIVE with green LED, FAIL with red LED).

The output voltage and the maximum load current are set by a control circuit, “REG CTRL”.

No indication is given when the 5 V regulators are overloaded or the power fails completely.

On the DSSS 171, supervisory logic circuitry is powered from the 24V_C bus (24V_CA), a 24VS terminal making the 24V inlet/outlet for redundant powering the logics of compatible DSSS units within a system as required.

Supervisory Logic is watching 24V_A and 24V_B voltage levels. The LEDs A and B at the DSSS 171 front panel will indicate:

LIVE / green = Voltage above min. level

FAIL / red = Voltage below min. level.

The output signals LIVE24_A/B and FAIL24_A/B are sent synchronously with the corresponding LED indications. The red panel LED, PBC FAIL, will light for a voltage black-out at the PBC - bus in the subrack. Where the 24VS is not connected, PBC FAIL means a blown fuse F524 in the DSBB 188. (Where the 24VS is connected for redundant supervisory power supply PBC FAIL can also indicate a low voltage at the 24V_A and 24V_B terminals; thus, the LEDs A FAIL and B FAIL will light together with the PBC FAIL LED.)

Key data for the power voting unit DSSS 171 and the power bus plane DSBB 188 is presented in the table below.

Table 4-2. Key Data for the Power Voting Unit DSSS 171 and the Power Bus Plane DSBB 188

Data	DSSS 171 + DSBB 188
Input voltage	DC 35 V (max) (X1 - 24V_A; X2 - 24V_B; X6.4, X7.4 - 24VS)
Outputs	X24 - 24V (24 V PBC - bus connection) X8:1 - 24VF (24V outlet to power back-up unit, if any)
Fuses	
- F501 (24V_A)	Midget, 15 A fast, (max 16 AF) Power Inlet
- F502 (24V_B)	Midget, 15 A fast, (max 16 AF) Power Inlet
- F514 (24VF)	Midget, 1 A fast, Power Outlet (Batt. Ch.)
- F518 (24VS)	Midget, 1 A fast, Power Inlet/Outlet (Supervis. Logic)
- F524 (24V)	Midget, 10 A fast, Power Outlet (PBC - bus)
Output signals	24 V, current limit 13 mA, short circuit protected (LIVE24_A, LIVE24_B, FAIL24_A, FAIL24_B)
Trip levels:	
- increasing voltage	19.4 V
- decreasing voltage	18.4 V

Key data for the regulator unit DSSR 170 is presented in Table 4-3.

Table 4-3. Key Data for the Regulator Unit DSSR 170

Data	DSSR 170
Input voltage	24 ± 6 V d.c.
Maximum input power	75 W
Maximum input power at overload (5 V, 12 A)	max 85 W
Output voltage (10 A load), min	5.0 V
Output voltage (1 A load), max	5.4 V
Maximum load	10 A
Current limit	11 ± 1 A
Efficiency (with 10 A load)	Minimum 70%
Conversion factor: (@ U_{in} = 24 V, U_{out} = 5.2 V)	$I_{out}/I_{in} \cong 3.2$
Fuse (miniature, 5 x 20 mm, fast)	5 A
Width x depth x height	49 x 109 x 138 mm

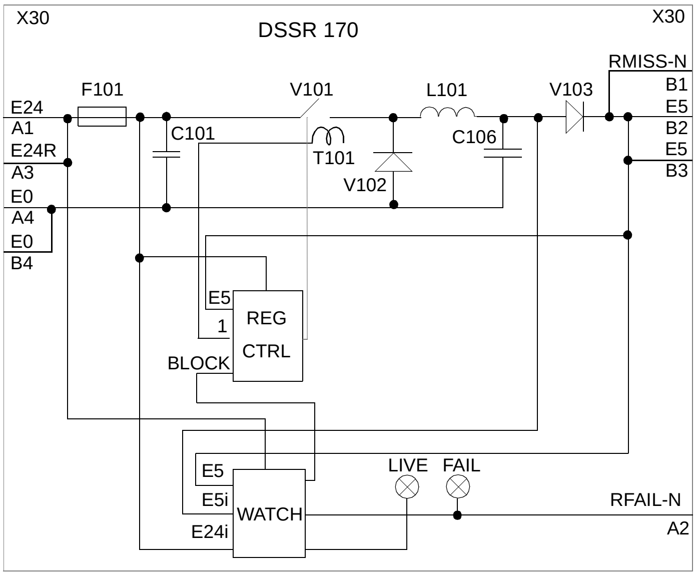


Figure 4-12. Block Diagram for DSSR 170

4.6 Mounting Bar for Connection Units (RA120/RA121/RA122)

You can install the mounting bar at the rear of the cabinet. Fix connection units on the bar with self-tapping screws. The mounting bar consists of an aluminum section and a steel cable duct, screwed together (see Figure 4-13). The mounting bar constitutes an earthing plane for the connection units.

The only difference between the mounting bars is the space requirement for installation. See Table 4-4 below.

Table 4-4. Mounting Bars RA120/RA121/RA122, Key Data

Mounting Bar	Space Required
RA120	19” x 3S(1)
RA121	24” x 3S(1)
RA122	24” x 3S(2)

(1) Where S = 44.45 mm.

(2) For object oriented connection units

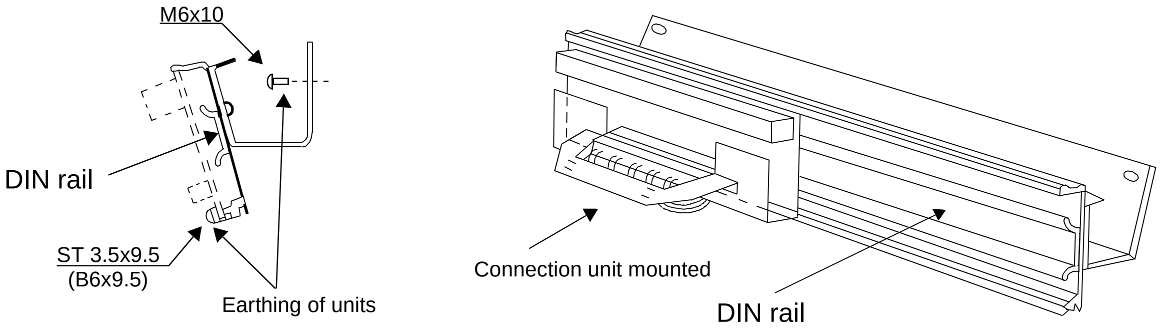


Figure 4-13. Mounting Bar RA120

Chapter 5 Input/Output Boards

5.1 General

In the following tables you will find the Technical Data and Performance of the S100 I/O.

An I/O set consists of one or two I/O boards, one or two cables and one or several connection units. The reason for presenting S100 I/O in sets is that the function is defined by an I/O board and the corresponding connection units.

BOCU = Board Oriented Connection Units
OOCU = Object Oriented Connection Units.

* For other cable lengths see price book. (DSTK 221L3 means cable length 3 meter).

Table 5-1. Analog Input Sets for S100 I/O with BOCU

I/O Set	Description
DSAI 130 DSTA 131 DSTK 221L3* or DSAI 130A DSTA 131 DSTK 221L3	16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 100 V, CMRR > 100 dB (50 Hz) 16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 50 V, CMRR > 100 dB (50 Hz), I/O channels isolated as one group.
DSAI 130 DSTA 133 DSTK 221L3 or DSAI 130A DSTA 135 DSTK 221L3	8 channels differential+8 channels single ended, each channel separately fuse-protected, resolution 12 bit, 0 to± 10 V or 0 to ±20 mA shunt 250 Ω 0.05%, for 2-wire transmitters CMV 100 V, CMRR > 100 dB (50 Hz). 16 channels differential, each channel separately protected, resolution 12 bit, 0 to± 10 V or 0 to ±20 mA, shunt 250 Ω 0.05%, for 2-wire transmitters CMV 50 V, CMRR > 100 dB (50 Hz), I/O channels isolated as one group.
DSAI 133 2 x DSTA 002A DSTK 222L3 or DSAI 133A 2 x DSTA 002B DSTK 222L3	32 channels, resolution 12 bit, single-ended 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05% 32 channels, resolution 12 bit, single-ended 0 to +10 V, 0 to +20 mA, shunt 250 Ω 0.05%, I/O channels isolated as one group.
2 x DSAI 133 2 x DSTA 002A 2 x DSTK 222L3 or 2 x DSAI 133A 2 x DSTA 002B 2 x DSTK 222L3	With redundancy: 32 channels, resolution 12 bits, single-ended 0 to + 10V or 0 to +20mA, shunt 250 Ω 0.05% With redundancy: 32 channels, resolution 12 bit, single-ended 0 to +10 V, 0 to +20 mA, shunt 250 Ω 0.05%, I/O channels isolated as one group.

Table 5-1. Analog Input Sets for S100 I/O with BOCU (Continued)

I/O Set	Description
DSAI 146 DSTA 145 DSTK 229SL3	31 (+ 1 ref.) channels for Pt100, 3-wire, resolution 12 bits, -100/ +320 or -200/ + 640 °C. Galvanic isolation between channel and system.
DSAI 155A DSTA 156 DSTK 225SL3 or DSAI 155A DSTA 156B DSTK 225SL3	14 (+ 2 ref. + 1 CJT input) channels for thermocouples, resolution 12 bits, measurement ranges B, C, E, J, K, R, S, T for thermocouples with floating output signal, CMV 15 V, CMRR > 100 dB (50 Hz) 1 CJT input Galvanic isolation between channel and system.
DSTA 155 or DSTA 155P	Could Junction Temperature (CJT) compensation. Used between the thermocouples and DSTA 156 Connection unit for the cold junction temperature compensation (CJT). Used between the thermocouples and DSTA 156B or in connection with DSTK 225SL3 without DSTA 156B Disconnectable screw terminal blocks.

Table 5-2. Analog Output Sets for S100 I/O with BOCU

I/O Set	Description
DSAO 110* DSTA 160 DSTK 223L3	4 channels, resolution 12 bits, 0 to ±10 V (min load 600 Ω) or 0 to ±20 mA (max load 500 Ω) channel wise galvanic isolation. DSTA 160 length 80 mm (3.2”)
DSAO 120A DSTA 171 DSTK 221L3	8 channels, resolution 12 bits + sign, 0 to ±10 V (min load 1000 Ω) or 0 to ±20 mA (max load 600 Ω) channel wise galvanic isolation. DSTA 171 length 120 mm (4.7”)
DSAO 120** DSTA 170 DSTK 223L3	8 channels, resolution 12 bits, 0 to ±10 V (min load 2000 Ω) or 0 to ±20 mA (max load 500 Ω). DSTA 170 length 160 mm (6.3”)
DSAO 130A DSTA 181 DSTK 221L3	16 channels, resolution 12 bits, 0 to +20 mA (max load 850 Ω). DSTA 181 length 120 mm (4.7”) I/O channels isolated as one group.
DSAO 130** DSTA 180 DSTK 221L3	16 channels, resolution 8 bits, 0 to +10 V (min load 500 Ω) or 0 to +20 mA (max load 950 Ω at 24 V). DSTA 180 length 240 mm (9.4”)

* When released, the DSAO 120A will functionally replace the DSAO 110 and DSAO 120.
** When released, the DSAO 130A will replace the DSAO 130 and to some extent DSAO 120.

Table 5-3. Analog Input/Output sets for S100 I/O with BOCU

I/O Set	Description
DSAX 110 DSTA 001A DSTK 223L3 or DSAX 110A DSTA 001B DSTK 223L3	8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%. 8 output channels, resolution 12 bits, 0 to +20 mA or 0 to +10 V (over shunt 500 Ω 0.1% on DSTA 001A or DSTA 001B). DSAX 110A has galvanic isolation between channel and system
2 x DSAX 110 DSTA 001A 2 x DSTK 223L3 or 2 x DSAX 110A DSTA 001B 2 x DSTK 223L3	For redundancy, 8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%. 8 output channels, resolution 12 bit, 0 to +20 mA or 0 to + 10 V (over shunt 500 Ω 0.1% on DSTA 001A or DSTA 001B). DSAX 110A has galvanic isolation between channel and system

Table 5-4. Analog Input/output sets for S100 I/O with OOCU

I/O Set	Description
DSAI 130 DSAO 130 DSTA 137 2 x DSTK 221L5 or	16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 100 V, CMRR > 100 dB (50 Hz) 16 output channels, resolution 8 bits, 0 to +10 V (min load 500 Ω) or 0 to +20 mA (max load 950 Ω at 24 V).
DSAI 130A DSAO 130A DSTA 138 2 x DSTK 221L5	16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 50 V, CMRR > 100 dB (50 Hz) 16 output channels, resolution 12 bits, 0 to +20 mA (max load 850 Ω). Galvanic isolation between channel and system

Table 5-5. Analog Input/Output sets for S100 I/O with BOCU and support for HART multiplexer

I/O Set	Description
DSAI 133 2 x DSTA 002A DSTK 231L5 or	16 + 16 channels, resolution 12 bit, single-ended 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%.
DSAI 133A 2 x DSTA 002B DSTK 231L5	16 + 16 channels, resolution 12 bit, single-ended 0 to +10 V, 0 to +20 mA, shunt 250 Ω 0.05%. Galvanic isolation between channel and system

Table 5-5. Analog Input/Output sets for S100 I/O with BOCU and support for HART multiplexer (Continued)

I/O Set	Description
2 x DSAO 120 2 x DSTA 170 DSTK 232L5	16 channels, resolution 12 bits, 0 to ±10 V (min load 2000 Ω) or 0 to ±20 mA (max load 500 Ω). DSTA 170 length 160 mm (6.3”)
DSAO 130A DSTA181 DSTK 240L5	16 channels, resolution 12 bits, 0 to +20 mA (max load 850 Ω). DSTA 181 length 120 mm (4.7”). Galvanic isolation between channel and system
DSAO 120 DSTA 170 DSTK 232L5	8 channels, resolution 12 bits, 0 to ±10 V (min load 2000 Ω) or 0 to ±20 mA (max load 500 Ω). (occupies 16 channels in the multiplexer)
DSAX 110 DSTA 001A DSTK 230L5 or DSAX 110A DSTA 001B DSTK 230L5	8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%. 8 output channels, resolution 12 bits, 0 to +20 mA or 0 to +10 V (over shunt 500 Ω 0.1% on DSTA 001A or DSTA 001B) DSAX 110A has galvanic isolation between channel and system

Table 5-6. Digital Input Sets for S100 I/O with BOCU

I/O Set	Description
DSDI 110A DSTD 190 DSTK 221L3 or DSDI 110AV1 DSTD 190V1 DSTK 221L3	32 channels, 24 V d.c., controlled by scanning or interrupt, pulse extension Local time tagging of process events Galvanic isolation between channel and system.
DSDI 110A DSTD 150A DSTK 221L3 or DSDI 110AV1 DSTD 150A DSTK 221L3	32 channels, 24 V d.c., controlled by scanning or interrupt, pulse extension Local time tagging of process events Disconnectable screw terminal blocks Galvanic isolation between channel and system.

Table 5-6. Digital Input Sets for S100 I/O with BOCU (Continued)

I/O Set	Description
DSDI 110A or DSDI 110AV1 and DSTK 226L3	4 x 8 channels, input voltage according to connection unit, controlled by scanning or interrupt, pulse extension Local time tagging of process events Galvanic isolation between channel and system.
DSTD 195	- Connection unit for 8 channels, 24 V d.c. all channels galvanically isolated
DSTD 196 or DSTD 196P	- Connection unit for 8 channels, 24 V d.c. (48 V d.c over open input)
DSTD 197	- Connection unit for 8 channels, 110 V d.c. or 120 V a.c. All channels galvanically isolated.
DSTD 198	- Connection unit for 8 channels, 230 V a.c. All channels galvanically isolated.
DSDI 120A DSTD 190 DSTK 221L3 or DSDI 120AV1 DSTD 190V1 DSTK 221L3	32 channels, 48 V d.c., controlled by scanning or interrupt, pulse extension Local time tagging of process events. Galvanic isolation between channel and system.
DSDI 120A DSTD 150A DSTK 221L3 or DSDI 120AV1 DSTD 150A DSTK 221L3	32 channels, 48 V d.c., controlled by scanning or interrupt, pulse extension. Local time tagging of process events Disconnectable screw terminal blocks. Galvanic isolation between channel and system.

Table 5-7. Digital Output Sets for S100 I/O with BOCU

I/O Set	Description
DSDO 115 DSTK 226L3	32 channels, 24- 250 V a.c./d.c. For connection units, see DSTD 108/DSTD 108L below. Galvanic isolation between channel and system.
DSDO 115A DSTK 226L3	32 channels, 24- 250 V a.c./d.c. For connection units, see DSTD 108P/DSTD 108LP/DSTD 109P below. Galvanic isolation between channel and system.
DSDO 115 DSTD 190 DSTK 221L3 or DSDO 115A DSTD 190V1 DSTK 234L3	32 channels, 24 V d.c., short-circuit proof transistor outputs, max. 150 mA. Galvanic isolation between channel and system. 32 channels, 24 V d.c., short-circuit proof transistor outputs, max. 500 mA. Galvanic isolation between channel and system.
DSDO 115 DSTD 110A DSTK 221L3 or DSDO 115A DSTD 110A DSTK 221L3	32 channels, 24 V d.c. short-circuit proof transistor outputs, max. 150 mA. Screw terminal with breakers. Galvanic isolation between channel and system. 32 channels, 24 V d.c. short-circuit proof transistor outputs, max. 150 mA.(Limited by DSTD 110A). Screw terminal with breaker. Galvanic isolation between channel and system.
DSDO 120 DSTD 120A DSTK 220L3,2	16 channels, 24/48 V d.c., transistor outputs, max. 1 A. Galvanic isolation between channel and system.
DSTD 108 or DSTD 108P	Connection unit with 8 relay channels Input: 24 V d.c. Output: 24-250 V a.c./d.c.* Max 3A/720VA. All channels galvanically isolated.
DSTD 108L or DSTD 108LP	Connection unit with 8 relay channels Input: 24 V d.c. Output: 24-2 50 V a.c./d.c.** Max 0,2A/5VA. All channels galvanically isolated.
DSTD 109P	Connection unit with eight (8) digital outputs, 24 V d.c., 2 A, with common power supply.

* Relay data: Load current: max. 3 A, min. 0.1 A at 24 V or 2.5 VA.
Breaking capacity: a.c. max 720 VA at cos F > 0.4, d.c. max. 44 W at L/R <40 ms

** Relay data for L version: Load current: max. 100 mA. min. 0.5 mA or 2.5 VA. Breaking capacity: a.c. max 100 mA or 5 VA at cos F > 0.4, d.c. max. 100 mA or 5 VA at L/R <40 ms

Table 5-8. Digital Input/Output set for S100 I/O with OOCU

I/O Set	Description
2 x DSDI 110A DSDO 115 4 x DSTD 145 3 x DSTK 226L5 or 2 x DSDI 110AV1 DSDO 115A 4 x DSTD 145 3 x DSTK 226L5	32 object x (2DI + 1DO) 64 input channels, 24 V d.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs *
4 x DSDI 110A DSDO 115 4 x DSTD 145 5 X DSTK 226L5 or 4 x DSDI 110AV1 DSDO 115A 4 x DSTD 145 5 X DSTK 226L5	32 object x (4DI + 1DO) 128 input channels, 24 V d.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs*
2 x DSDI 110A DSDO 115 4 x DSTD 147 3 x DSTK 226L5 or 2 x DSDI 110AV1 DSDO 115A 4 x DSTD 147 3 x DSTK 226L5	32 object x (2DI + 1DO) 64 input channels, 120 V a.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs*
4 x DSDI 110A DSDO 115 4 x DSTD 147 5 x DSTK 226L5 or 4 x DSDI 110AV1 DSDO 115A 4 x DSTD 147 5 x DSTK 226L5	32 object x (4DI + 1DO) 128 input channels, 120 V a.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs*

Table 5-8. Digital Input/Output set for S100 I/O with OOCU (Continued)

I/O Set	Description
2 x DSDI 110A DSDO 115 4 x DSTD 148 3 x DSTK 226L5 or 2 x DSDI 110AV1 DSDO 115A 4 x DSTD 148 3 x DSTK 226L5	32 object x (2DI + 1DO) 64 input channels, 230 V a.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs*
4 x DSDI 110A DSDO 115 4 x DSTD 148 5 x DSTK 226L5 or 4 x DSDI 110AV1 DSDO 115A 4 x DSTD 148 5 x DSTK 226L5	32 object x (4DI + 1DO) 128 input channels, 230 V a.c., controlled by scanning or interrupt, pulse extension, local time tagging of process events 32 output channels, 24- 250 V a.c./d.c., relay outputs*

* Relay data: Load current: max. 3 A, min. 0.1 A at 24 V or 2.5 VA.
Breaking capacity: a.c. max 720 VA at cos F > 0.4, d.c. max. 44 W at L/R <40 ms

Table 5-9. Positioning and Pulse Counting Sets for S100 I/O with BOCU

I/O Set	Description
DSDP 140A DSTD 190 DSTK 225SL3	Positioning Set for one Positioning Loop Pulse encoder input: 3 ch., ±15 mA, max. 80 kHz DI/DO: 24 V d.c. AO: resolution 11 bits, 0 to ±10V or 0 to ±20 mA
DSDP 140A DSTD 150A DSTK 225SL3	Positioning Set for one Positioning Loop Pulse encoder input: 3 ch., ±15 mA, max. 80 kHz DI/DO: 24 V d.c. AO: resolution 11 bits, 0 to ±10V or 0 to ±20 mA Disconnectible screw terminal blocks
DSDP 150 DSTD 190 DSTK 225SL3	Pulse Counting Set 12 ch., 5/12/24 V d.c. max. 10 kHz

Table 5-9. Positioning and Pulse Counting Sets for S100 I/O with BOCU (Continued)

I/O Set	Description
DSDP 150 DSTD 150A DSTK 225SL3	Pulse Counting Set 12 ch., 5/12/24 V d.c. max. 10 kHz Disconnectible screw terminal blocks
DSDP 170 DSTX 170 DSTK 228L3	Pulse Counting Set 4 measuring systems each containing: Pulse encoder input: 2 ch. + strobe 5/12/24 V or ±15mA max. 2.5 MHz DI: 24 V d.c and DO: 24 V, 250 mA d.c

Table 5-10. S100 I/O Sets supporting Intrinsic Safety System

I/O Set		Description
Cable 10 m (25 ft.)	**Cable 15m (37.5 ft.)**	
DSAI 130 DSTK 225SL10 or DSAI 130A DSTK 225SL10	DSAI 130 DSTK 225SL15 or DSAI 130A DSTK 225SL15	16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 100 V, CMRR > 100 dB (50 Hz) 16 channels, resolution 12 bit, differential, 0 to ±10 V or 0 to ±20 mA, shunt 250 Ω 0.1% CMV 50 V, CMRR > 100 dB (50 Hz). Galvanic isolation between channel and system
DSAI 133 DSTK 222SL10 or DSAI 133A DSTK 222SL10	DSAI 133 DSTK 222SL15 or DSAI 133A DSTK 222SL15	32 channels, resolution 12 bit, single-ended 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05% 32 channels, resolution 12 bit, single-ended 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%. Galvanic isolation between channel and system
DSAO 120 DSTK 223SL10	DSAO120 DSTK 223SL15	8 channels, resolution 12 bits, 0 to ±10 V (min load 2000 Ω) or 0 to ±20 mA (max load 500 Ω).
DSAX 110 DSTK 223SL10 or DSAX 110A DSTK 223SL10	DSAX 110 DSTK 223SL15 or DSAX 110A DSTK 223SL15	8 input channels, resolution 12 bits, single-ended, 0 to +10 V or 0 to +20 mA, shunt 250 Ω 0.05%. 8 output channels, resolution 12 bits, 0 to +20 mA. Galvanic isolation between channel and system

Table 5-10. S100 I/O Sets supporting Intrinsic Safety System (Continued)

I/O Set		Description
Cable 10 m (25 ft.)	**Cable 15m (37.5 ft.)**	
DSDI 110A DSTK 225SL10 or DSDI 110AV1 DSTK225SL10	DSDI 110A DSTK 225SL15 or DSDI 110AV1 DSTK225SL15	32 channels, 24 V d.c. input voltage, controlled by scanning or interrupt, pulse extension. Local time tagging of process events. Galvanic isolation between channel and system.
DSDO 115 DSTK 225SL10 or DSDO 115 DSTK 225SL10	DSDO 115 DSTK 225SL15 or DSDO 115A DSTK 225SL15	32 channels, output 24 V d.c. Galvanic isolation between channel and system.
DSDP 150 DSTK 225SL10	DSDP 150 DSTK 225SL15	Pulse Counting Set 12 ch., 5/12/24 V d.c. max. 10 kHz

Table 5-11. Sets for connection of Thyristor Converters for S100 I/O with BOCU

I/O Set	Description
DSDC 111 DSTX 110 DSTK 224L3	Set for connection of 1 analog controlled thyristor converter to Advant Controller 400 Series

Table 5-12. Special Units

Consists of	Description
DSTY 101*	**Analog isolation amplifier** to be mounted on the mounting bar DSRA 110. Input/Output: 0 to ±10V or 0 to ±20 mA, single-ended. Inaccuracy: max error in linearity 0.3% max error in symmetry 0.5%. Isolation voltage: 3 kV Supply Voltage: 24 V d.c.

* **NOT** verified for CE-marking.
Only available in price list “Spare Parts for Advant Controller 400 Series”.

5.2 Analog Input Boards (DSAI xxx)

Six different types of analog input boards are used in the I/O system.

Use the boards DSAI 110, DSAI 130, DSAI 130A, DSAI 133 or DSAI 133A to connect all current and voltage signals. You can also use the DSAI 133/DSAI 133A in pairs for redundant connection.

Use the boards DSAI 145, DSAI 146 or DSAI 151 to connect Pt 100-type resistance thermometers (RTD).

Use the board DSAI 155 or 155A for thermocouple-type temperature transducers.

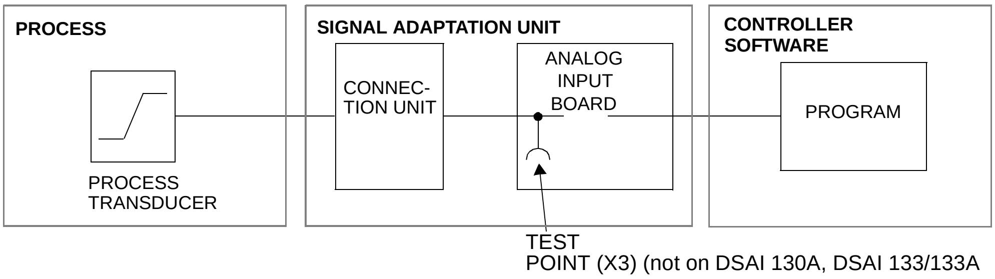


Figure 5-1. Analog Input Signal, Block Diagram

Analog input boards function, in general, as follows:

The boards are provided with a number of channels. Interference suppression, filtration and adaptation of the signal with respect to zero point and gain are performed individually in a buffer amplifier. The A/D converter is multiplexed between the input channels. An input channel is selected by the controller software by writing to a parameter register, which also starts the A/D conversion. The value, converted to digital form, is then transferred via the parallel data bus to the controller software for further signal processing.

DSAI 133 or 133A has, however, internal logic which controls the A/D conversion cyclically. Automatic adjustment of both zero point and gain are also performed with the help of the board processor. For other boards except DSAI 130A, the zero point and gain must be adjusted manually or by the controller software.

Because of certain functional differences between signal processing of standard current/voltage signals and signal processing of special temperature measurements, these two board groups are described in individual sections. The boards and the connection units can be combined as shown in the tables below.

DSAI 146 is functionally compatible with DSAI 145 in connection with the connection unit DSTA 145.

DSAI 130A, DSAI 133A, DSAI 146 and DSAI 155A are galvanically isolated between channels and system.

NOTE

A live zero point for standard current range 4 - 20 mA is obtained by the controller software.

Table 5-13. Analog Input Boards, Key Data

Data	**DSAI 110** **DSTA 121A** **DSTK 150/** **DSTK 221**	**DSAI 130**			**DSAI 133**
		DSTA 131 **DSTK 150/** **DSTK 221**	**DSTA 133** **DSTK 150/** **DSTK 221**	**DSTA 137**[6] **DSTK 150/** **DSTK 221**	**2 x DSTA 002A**[1] **DSTK 152/** **DSTK 222**
Number of channels	32	16	16 (8 + 8)	16 (16 x 1)[5]	32 (2 x 16)
Type of input	Single/ Unipolar	Differential/ Bipolar	8 diff + 8 single ended	Differential/ Bipolar	Single, unipolar
Input impedance (at voltage input)	> 10 MΩ	2 MΩ	2 MΩ	2 MΩ	10 MΩ
Measurement range[4]	0 - ±10 V 0 - ±5 V 0 - ±2.5 V 0 - ±1.25 V 0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - ±10 V 0 - ±5 V 0 - ±2.5 V 0 - ±1.25 V 0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - ±10 V 0 - ±5 V 0 - ±2.5 V 0 - ±1.25 V 0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - +10 V 0 - +5 V 0 - +20 mA
Shunt resistance	250 Ω	250 Ω	250 Ω	250 Ω	250 Ω
Shunt inaccuracy	0.1%	0.1%	0.05%	0,1%	0.05%
CMV[2]	-	100 V	100 V	100 V	-
Low pass filter, number of poles	2	2	2	2	2
Cutoff frequency (3dB)	6.5 Hz	6.5 Hz	6.5 Hz	6,5 Hz	6.5 Hz
Attenuation of 50 Hz	> 32 dB	> 32 dB	> 32 dB	> 32 dB	> 32 dB
Resolution	8 bits + sign	12 bits + sign	12 bits + sign	12 bits + sign	12 bits
Max inaccuracy excl. shunt with Gain = 1	0.45%	0.05%	0.05%	0.05%	0.05%
Temp. drift, basic board with Gain=1:					
- Maximum	0.25%/10°C	0.1%/10°C	0.1%/10°C	0.1%/10°C	0.08%/10°C
- Typical	0.25%/10°C	0.05%/10°C	0.05%/10°C	0.05%/10°C	0.03%/10°C
Temperature drift, shunt:					
- Maximum	15 ppm/°C	15 ppm/°C	15 ppm/°C	15 ppm/°C	15 ppm/°C
- Typical	10 ppm/°C	10 ppm/°C	10 ppm/°C	10 ppm/°C	10 ppm/°C
Conversion time	< 100 µs	< 100 µs	< 100 µs	< 100 µs	[3]
Current consumption 24 V	130 mA	110 mA	110 mA	110 mA	130 mA
Current consumption 5 V	250 mA	250 mA	250 mA	250 mA	450 mA
Fusing of transducer supply	Common	Common	Individual	Individual (PTC)	Individual (PTC)
Interference immunity in acc. with:					
- EN 50082-2	yes	yes	yes	yes	yes
- IEC 255-4 impulse	3 kV	5 kV	5 kV	5 kV	5 kV
- IEC 255-4 1 MHz CMV/NMV[2]	2.5 kV/2.5 kV	2.5 kV/2.5 kV	2.5 kV/2.5 kV	2.5 kV/2.5 kV	1 kV

1) DSAI 133 requires two connection units (DSTA 002, DSTA 002A/ or DSTA 02B) per board. DSTA 002, DSTA 002A and DSTA 002B has 16 channels whereas the board has 32. With redundant coupling, the two boards use the same connection units.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
3) The access time for the data register on the board is ≤1,5µs and the updating time internally on the board is ≤25 ms.
4) The actual controller product defines which ranges are available.
5) 16 objects with one analog input on each object
6) This is an object oriented connection unit.

Table 5-14. Analog Input Boards, Key Data

Data	**DSAI 130A**			**DSAI 133A**
	DSTA 131 **DSTK 221**	**DSTA 135** **DSTK 221**	**DSTA 138**[6] **DSTK 226**	**2x DSTA 002B**[1] **DSTK 222**
Number of channels	16	16	16 (16 x 1)[5]	32 (2x16)
Type of input	Differential / Bipolar Galvanic isolated in one group			Single unipolar. Galvanic isolated in one group
Measurement range[4]	0 - ±10 V 0 - ±5 V 0 - ±2.5 V 0 - ±1.25 V 0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - ±10 V 0 - ±5 V 0 - ±2.5 V 0 - ±1.25 V 0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - ±20 mA 0 - ±10 mA 0 - ±5 mA	0 - +10 V 0 - +5 V 0 - +20 mA
CMV[2]	50 V			-
Low pass filter, number of poles	2			2
Cut off frequency (3dB)	6.5 Hz			6,5 Hz
Attenuation of 50 Hz	> 32dB			>32 dB
Resolution	12 bits + sign			12 bits
Max inaccuracy excl. shunt with Gain = 1	0.05%			0,05%
Temp. drift, basic board with Gain=1: - Maximum - Typical	0.1%/10°C 0.05%/10°C			0,08%/10°C 0,03%/10°C
Temperature drift, shunt: - Maximum - Typical	15 ppm/°C 10 ppm/°C			15 ppm/°C 10 ppm/°C
Conversion time	< 70 µs			< 2ms[3]
Current consumption 24 V	150 mA			100 mA
Current consumption 5 V	300 mA			260 mA
Fusing of transducer supply	Common	Individual (PTC)	Individual (PTC)	Individual (PTC)
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV[2]	yes 3 kV 2.5 kV/2.5 kV	yes 5 kV 2.5 kV/2.5 kV	yes 5 kV 2.5 kV/2.5 kV	yes 5 kV 1 kV

1) DSAI 133A requires two connection units (DSTA 002B) per board. DSTA 002B has 16 channels whereas the board has 32. With redundant coupling, the two boards use the same connection units.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
3) The access time for the data register on the board is ≤1,5µs and the updating time internally on the board is ≤2 ms.
4) The actual controller product defines which ranges are available.
5) 16 objects with one analog input on each object
6) This is an object oriented connection unit.

Table 5-15. Analog Input Boards, Key Data

Data	**DSAI 145/ DSAI 146 DSTA 145 DSTK 202/ DSTK 229**	**DSAI 151 DSTA 151 DSTK 160/ DSTK 225**	**DSAI 155**	**DSAI 155A**	**DSAI 155A**
			DSTA 156 1) DSTK 186	**DSTA 156 DSTK 160 DSTK 225**	**DSTA 156B DSTK 225**
Number of channels	31 + 1 ref	2 x (7+1ref)	14 + 2 ref + CJ	14 + 2 ref + CJ	14 + 2 ref + CJ
Type of input	Pt100, 3-wire	Pt100, 4-wire	Thermocouple	Thermocouple	Thermocouple
Input impedance	> 100 MΩ	> 100 MΩ	> 10 MΩ	> 10 MΩ	> 10 MΩ
Measurement range 6)	-100 - +320°C -200 - +640°C	-40 - +40°C -100 - +320°C -200 - +640°C	Thermocouple 2, 7) Type ex.: B, C, E, J, K, R, S and T. Comp. 3) for cold junction temp.	Thermocouple 2, 7) Type ex.: B, C, E, J, K, R, S and T. Comp. 3) for cold junction temp.	Thermocouple 2, 7) Type ex.: B, C, E, J, K, R, S and T. Comp. 3) for cold junction temp.
CMV 4) between channels	-	-	±16 V	±16 V	±16 V
Rated insulation voltage to system ground	-	-	–	–	50 V
Attenuation of 20, 30, 50 or 60 Hz	> 100 dB	> 100 dB	> 100 dB	> 100 dB	> 100 dB
Resolution	12/13 bits + sign	12/13 bits + sign	12/13 bits + sign	12/13 bits + sign	12/13 bits + sign
Max inaccuracy	0.15%	0.15% 0.3% @ -40 - +40°C	0.2% + 1°C 5)	0.2% + 1°C 5)	0.2% + 1°C 5)
Max temperature drift, basic board:	0.1%/10°C	0.07%/10°C	-	-	-
Conversion time (50 Hz)	< 65 ms	< 65 ms	< 65 ms	< 65 ms	< 65 ms
Current consumption 24 V	100 mA	100 mA	140 mA	140 mA	140 mA
Current consumption 5 V	350 mA	350 mA	350 mA	350 mA	350 mA
Interference immunity in acc. with:					
- EN 50082-2	yes	yes	yes	yes	yes
- IEC 255-4 impulse	5 kV	3 kV	3 kV	3 kV	3 kV
- IEC 255-4 1 MHz CMV/ NMV 4)	2.5 kV	2.5 kV / 2.5 kV	1 kV / 0.5 kV	1 kV / 0.5 kV	1 kV / 0.5 kV

1) Alternative only for **NOT** grounded thermocouple.
2) See IEC 584-1 for thermocouple types B, E, J, K, R, S and T. See DIN 43710 for thermocouple type C.
3) Compensation for cold junction: -40 - +100°C, inaccuracy 1°C.
4) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
5) Maximum error over the whole temperature range.
6) The actual controller product defines which ranges are available.

5.2.1 Signal Processing of Current and Voltage Signals

Signal processing of current and voltage signals, performed by the AI boards, includes the following procedures:

- Interference suppression
- Conversion of current signal to voltage signal
- Low pass filtration
- Multiplexing
- Gain selecting
- A/D conversion and
- Reading of process measured value.

Connect the signal wiring to screw terminals on the connection unit. You can use a shunt resistor on the unit for current signals. For voltage signals, disconnect the current shunt by cutting a solder jumper or move jumper strapping on newer connection units.

The signals are low pass filtered and the filtered signal is adapted to the measurement range of the A/D converter by means of board circuitry controlled by the controller software.

5.2.2 Signal Processing with Temperature Measurement

Signal processing with temperature measurement, performed by the AI boards, includes the following procedures:

- Interference suppression
- Adaptation to temperature transducer
- Low pass filtration
- Multiplexing
- Gain selecting
- A/D conversion and
- Reading of the process measured value.

You can connect two different types of temperature transducers: the resistance thermometer Pt 100 and the thermocouple.

With resistance thermometers, a constant measurement current is generated in a current generator on the board. The current is conducted through the temperature transducer. The resistance value in the transducer changes with the temperature in a defined manner and the voltage obtained over the transducer corresponds to the temperature. The voltage is measured on the board with an accurate measurement amplifier. A three- or four-wire connection is used to achieve a high degree of accuracy and to avoid the effects of the resistance in the lead to the transducer.

Thermoelectric voltage, which is a function of the temperature, is generated in the thermocouple. The voltage is mV size and is amplified on the board in an instrumentation amplifier with a high gain factor. The temperature measurement range is settled by the controller software. Table 5-16 contains an overview of the different types of thermocouples.

Thermocouples require special connection techniques with compensation cable and compensation for the temperature of the cold junction on the connection unit DSTA 155, DSTA 155A or DSTA 155P, normally located in the process. See also Section 5.2.5.2

Connection to the Process (Temperature Measurement). The transducer is connected in a normal way to screw terminals on a connection unit.

DSTA 155/DSTA 155P is connected to DSTA 156/DSTA 156B with a shielded multipair twisted cable.

With temperature measurement, an integrating A/D converter is used. The integration time is chosen so that the input signal is integrated during one period of the mains frequency.
Mains supply frequency interference is suppressed in this way. The mains supply frequency is specified with jumpers/switches on the temperature measurement board. The A/D conversion is initiated by the controller software and when the conversion is completed, the board generates an interrupt.

Table 5-16. Data for different Types of Thermocouples

Code	Type of Thermocouple	Measurement Range	Reference
B	Pt-30 Rh/Pt-6 Rh	+40°C to 1820°C 104°F to 3308°F	IEC 584-1 1977
C	W-5 Re/W-26 Re	0°C to 2320°C 32°F to 4208°F	Hoskins MFG.Co type C. This type is not defined in any standards.
E	Ni-10 Cr/Cu-Ni	-270°C to 870°C -454°F to 1598°F	IEC 584-1 1977
J	Fe/Cu-Ni	-210°C to 1200 °C -346°F to 2192°F	IEC 584-1 1977
K	Ni-Cr/Ni-Al	-270°C to 1372°C -454°F to 2501.6 °F	IEC 584-1 1977
R	Pt-13 Rh/Pt	-50°C to 1768°C -58°F to 3214.4°F	IEC 584-1 1977
R1680	Pt-13 Rh/Pt	-50°C to 1680°C -58°F to 3056°F	IEC 584-1 1977
S	Pt-10 Rh/Pt	-50°C to 1768°C -58°F to 3214.4°F	IEC 584-1 1977 (DIN 43710 1977)
T	Cu/Cu-Ni	-270°C to 400°C -454°F to 752°F	IEC 584-1 1977
T385	Cu/Cu-Ni	-270°C to 385°C -454°F to 725°F	IEC 584-1 1977

NOTE

The practically usable measurement range for thermocouples E, J, K, T and T385 is -200°C and upwards because of inadequate accuracy in the interval -270°C to -200°C.

5.2.3 Front Panels

Figure 5-2 shows the front panel of the boards DSAI 110, DSAI 145, DSAI 146, DSAI 151, DSAI 155 and DSAI 155A. A yellow LED on the front panel of the boards illuminates to indicate that A/D conversion is in progress. A red LED illuminates to indicate board fault.

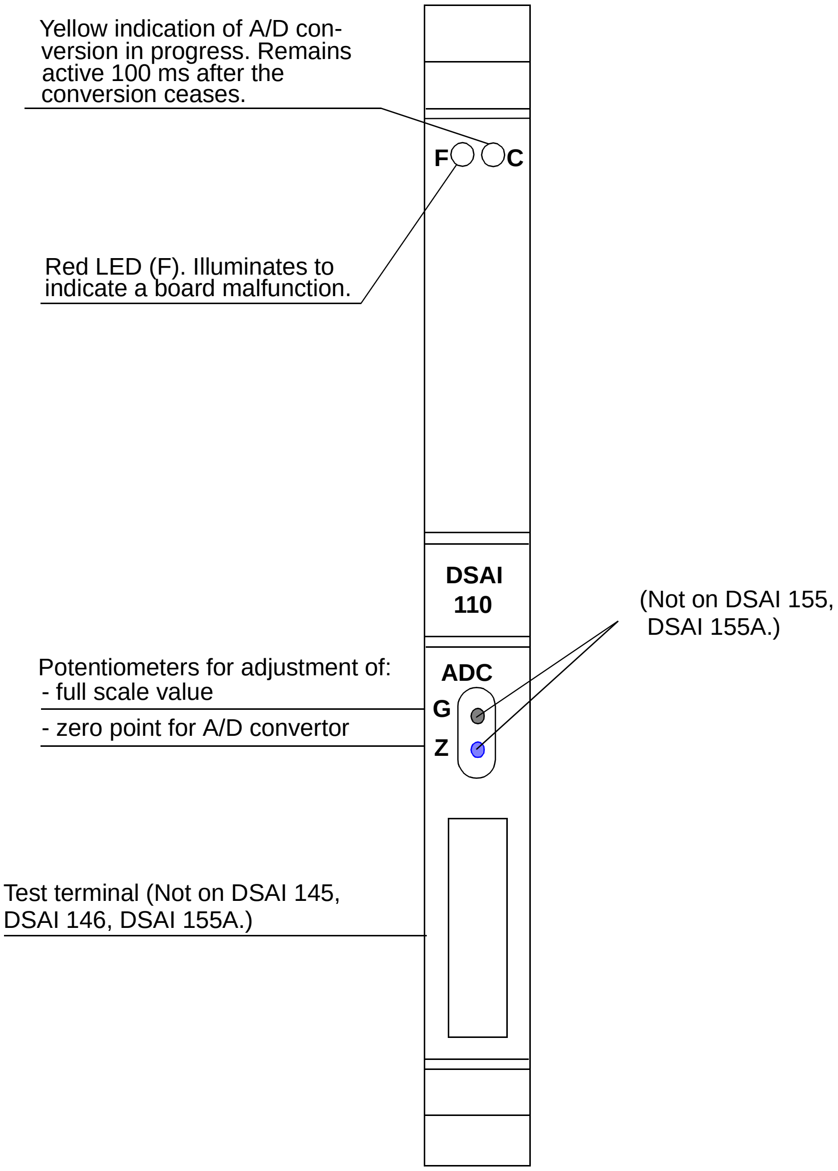

Yellow indication of A/D conversion in progress. Remains active 100 ms after the conversion ceases.
F
C
Red LED (F). Illuminates to indicate a board malfunction.
DSAI
110
(Not on DSAI 155, DSAI 155A.)
Potentiometers for adjustment of:
- full scale value
- zero point for A/D convertor
ADC
G
Z
Test terminal (Not on DSAI 145, DSAI 146, DSAI 155A.)

Figure 5-2. Front Panel of DSAI 110, DSAI 145, DSAI 146, DSAI 151, DSAI 155 and DSAI 155A

Figure 5-3 shows the front panel of the board DSAI 130.

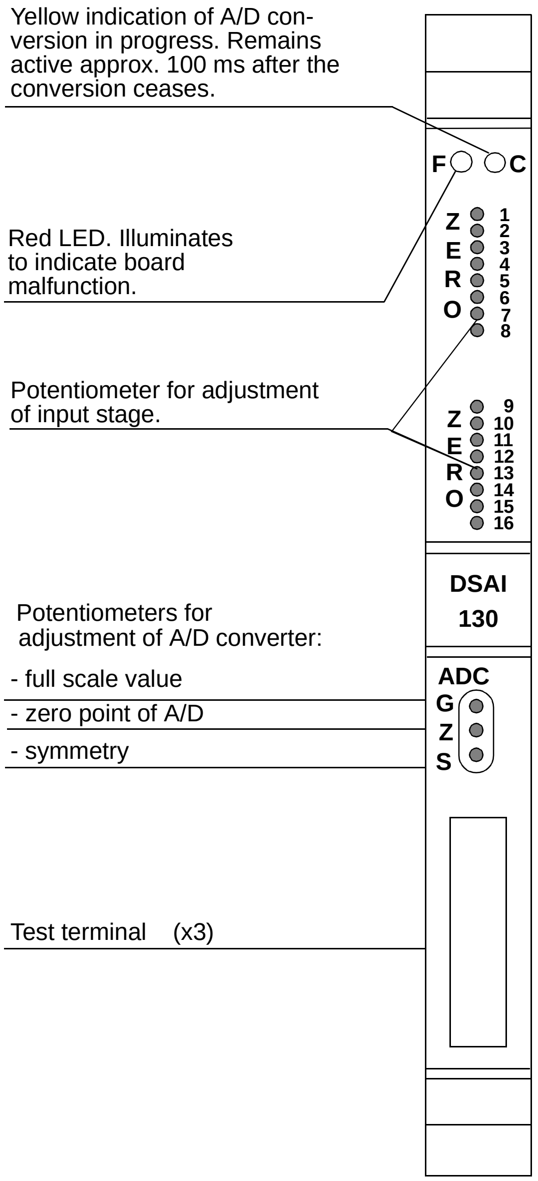
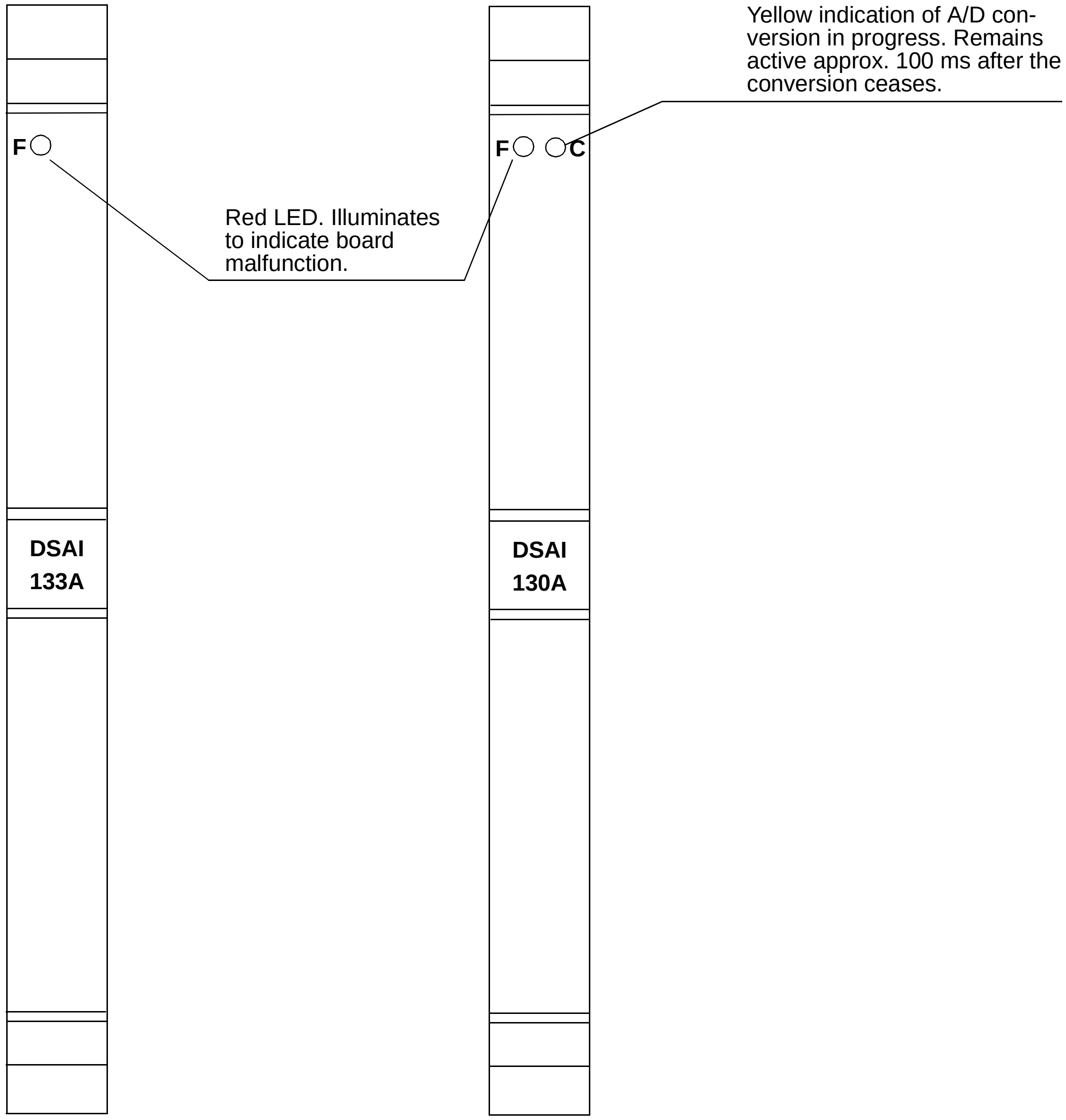

Yellow indication of A/D conversion in progress. Remains active approx. 100 ms after the conversion ceases.
Red LED. Illuminates to indicate board malfunction.
Potentiometer for adjustment of input stage.
Potentiometers for adjustment of A/D converter:
- full scale value
- zero point of A/D
- symmetry
Test terminal (x3)
F
C
ZERO
1 2 3 4 5 6 7 8
ZERO
9 10 11 12 13 14 15 16
DSAI
130
ADC
G
Z
S

Figure 5-3. Front Panel of DSAI 130



Yellow indication of A/D conversion in progress. Remains active approx. 100 ms after the conversion ceases.

Red LED. Illuminates to indicate board malfunction.

Figure 5-4. Front Panel of DSAI 133, DSAI 133A and DSAI 130A

5.2.4 Jumpering of AI Boards

Analog input boards are jumpered for different functions. Table 5-17 shows an overview of all jumpers/switches on the AI boards. The following sections describe these jumper/switch groups in more detail.

Table 5-17. Jumpering of AI Boards

Jumper/switch Function	**Jumper/switch Groups for Board Type**								
	DSAI 110	**DSAI 130**	**DSAI 130A**	**DSAI 133**	**DSAI 133A**	**DSAI 145**	**DSAI 146**	**DSAI 151**	**DSAI 155, DSAI 155A**
Address	S1								
Suppression of mains frequency interferences (20, 30, 50 or 60 Hz)	-					S3, S4			
For production test	S2	S2	-	S2	-	S2, S5		S2, S5	S2, S5, S6, S7

NOTE

Do not intermingle jumper groups with the prefix **S** and groups with the prefix **X** on the board. There should be no jumpers on the X group.

S2 does not exist on DSAI 155A and later version of DSAI 145, DSAI 151.
S6 and S7 does exist on DSAI 155A.

The following figures show the location of the jumper/switch groups on the AI boards.

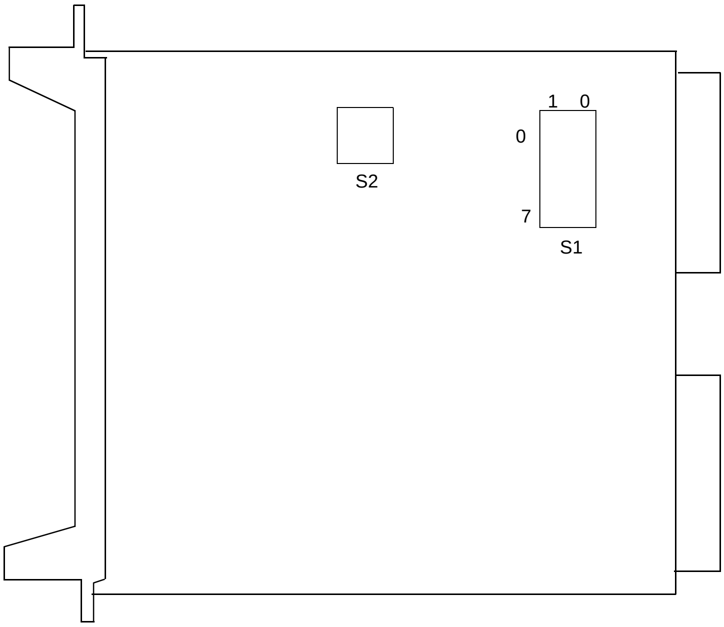


Figure 5-5. Analog Input Boards DSAI 110, DSAI 130 and DSAI 133, Location of Switch Groups

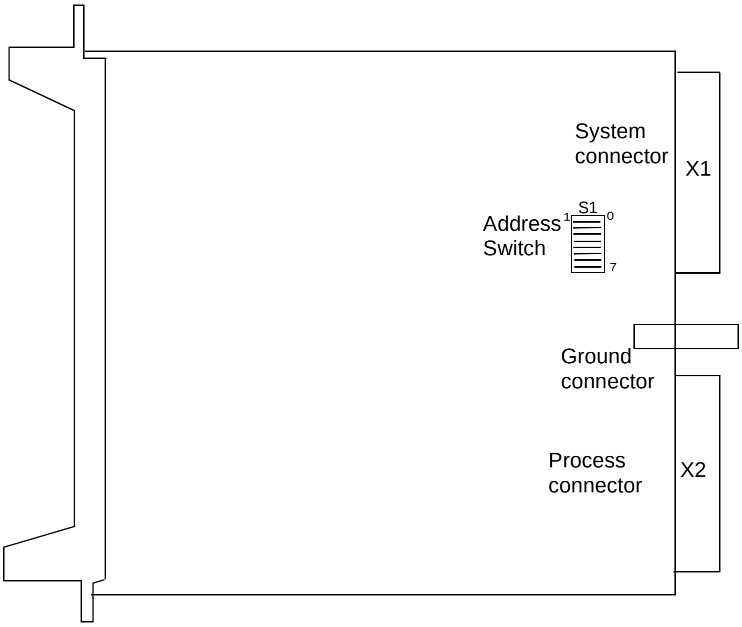


Figure 5-6. Analog Input Boards DSAI 130A, DSAI 133A Location of Switch Groups

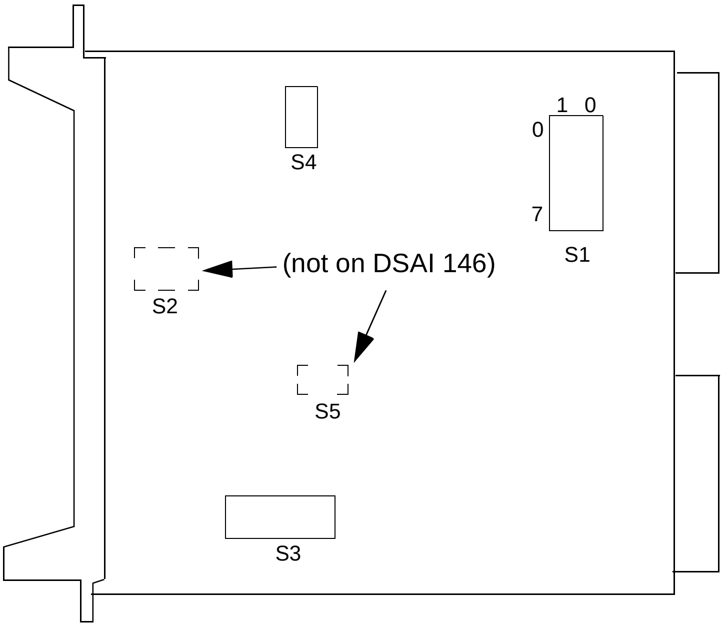


Figure 5-7. Analog Input Boards DSAI 145/DSAI 146 and DSAI 151, Location of Switch Groups

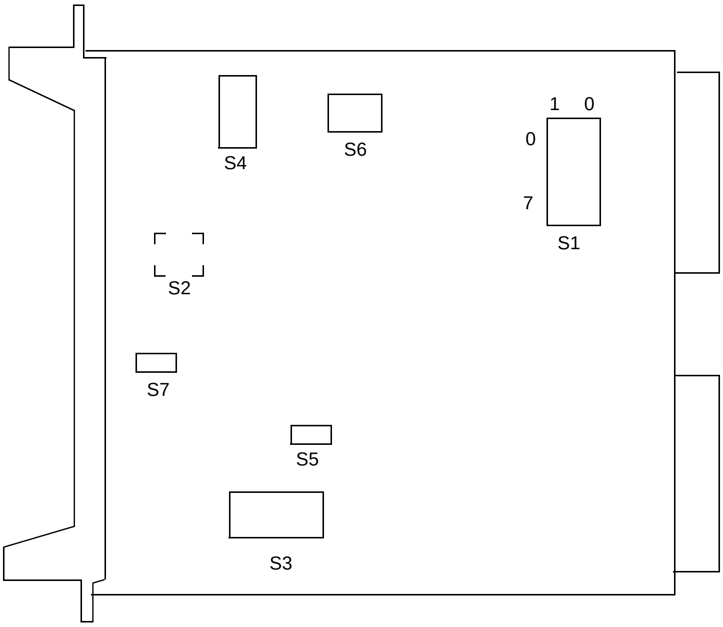


Figure 5-8. Analog Input Board DSAI 155, Location of Switch Groups

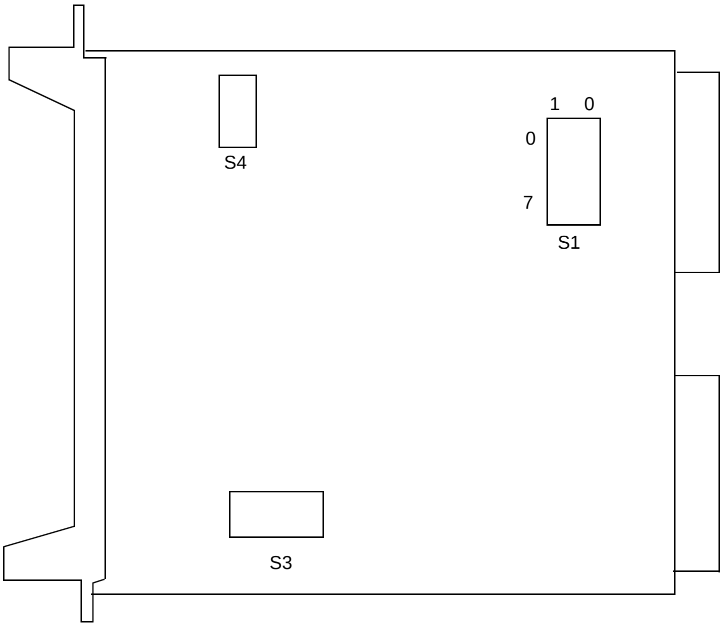


Figure 5-9. Analog Input Board DSAI 155A, Location of Switch Groups

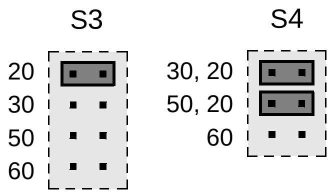
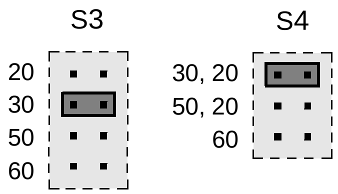
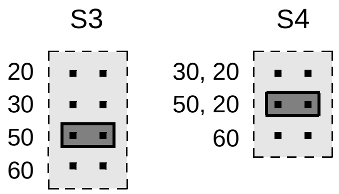
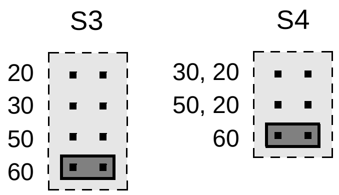
5.2.4.1 Address Switches

The address is set with the switch group S1. Newer boards use an address switch instead of jumpers. The address range for analog input boards is H’20 - H’3F (H’ = hexadecimal notation), which corresponds to the range 32 - 63 in decimal notation. With redundant coupling of DSAI 133/ DSAI 133A, the two boards have individual addresses and are switched to the address area H’C0 - H’EF, which corresponds to 192 - 239 in decimal notation. (If necessary, you can use the address range H’20 - H’EF as an extra area, after you check to make sure that the address is free.)

See Appendix A Address Jumpering for examples of address jumpering. Mains Frequency Interferences Jumpers/switches.

Use the switch groups S3 and S4 to suppress the effect of mains frequency interferences (20, 30, 50 or 60 Hz). This function is only provided on the boards DSAI 145/DSAI 146, DSAI 151 and DSAI 155/DSAI 155A (see Table 5-17). Table 5-18 shows how to jumper/switch the board to set it to suppress the actual mains frequency.

Table 5-18. Suppression of Mains Frequency Interferences, Switch Groups S3 and S4

Mains Frequency	**DSAI 145/DSAI 146, DSAI 151 and DSAI 155/DSAI 155A**
20 Hz	
30 Hz	
50 Hz	
60 Hz	

5.2.4.2 Production Test Switches

The switch groups S2, S5, S6 and S7 are used for production test purposes only. They shall always be set according to Figure 5-10. (Not all jumpers/switches are available on all boards. See Table 5-17.)

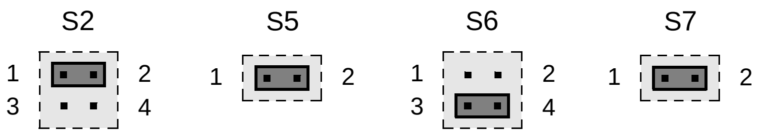


Figure 5-10. Jumpering of S2, S5, S6 and S7

5.2.5 Connection of AI Boards to the Process (DSTA xxx)

Connection Units and their Cables:.

Table 5-19. Connection Units and boards

Connection Units	Card	Cables
DSTA 001A	DSAX 110	DSTK 223L3 / DSTK 230L5*
DSTA 001B	DSAX 110A	DSTK 223L3 / DSTK 230L5*
DSTA 002A	DSAI 133	DSTK 222L3
DSTA 002B	DSAI 133/ DSAI 133A	DSTK 222L3 / DSTK 231L5*
DSTA 131	DSAI 130/ DSAI 130A	DSTK 221L3
DSTA 133	DSAI 130	DSTK 221L3
DSTA 135	DSAI 130A	DSTK 221L3
DSTA 137	DSAI 130	DSTK 221L5
DSTA 138	DSAI 130A	DSTK 221L5
DSTA 145	DSAI 146	DSTK229SL3
DSTA 155P	DSAI 155A	DSTK 225SL3
DSTA 156	DSAI 155A	DSTK 225SL3
DSTA 156B	DSAI 155A	DSTK 225SL3
DSTA 160	DSAO 110	DSTK 223L3
DSTA 170	DSAO 120	DSTK 223L3 / DSTK 232L5*
DSTA 171	DSAO 120A	DSTK 221L3
DSTA 180	DSAO 130	DSTK 221L3
DSTA 181	DSAO 130A	DSTK 221L3 / DSTK 240L5*

* For HART mux connection

Table 5-20 below lists technical data for the connection units DSTA 002A, DSTA 002B, DSTA 121A, DSTA 131, DSTA 133, DSTA 135, DSTA 137, DSTA 138, DSTA 145, DSTA 151, DSTA 155 and DSTA 156, all of which are intended for analog input signals. The connection units have interference suppression and shunt resistors which are used with current signals.

The signal cable connected to the connection units can be screened or not screened. The cable area depends on the type of connection. See Table 5-20 below.

Table 5-20. Key Data of the Connection Units

Data	**DSTA 002A DSTA 002B**	**DSTA 121A**	**DSTA 131**	**DSTA 133**	**DSTA 135**	**DSTA 137 1) DSTA 138 1)**	**DSTA 145**	**DSTA 151**	**DSTA 155**	**DSTA 155P**	**DSTA 156**	**DSTA 156B**
Shunt resistor	250 Ω	250 Ω	250 Ω	250 Ω	250 Ω	250 Ω	-	-	-	-	-	-
Fuses	0.15 A (PTC)	1.0 A fast glass tube 20 x 5 mm	0.1 A fast glass tube 20 x 5 mm	50 mA fast glass tube 20 x 5 mm	0.15 A (PTC)	0.15 A (PTC)	-	-	-	-	-	-
Cables to DSAI	DSTK 152 / DSTK 222	DSTK 150	DSTK 150/ DSTK 221	DSTK 150/ DSTK 221	DSTK 150/ DSTK 221	DSTK 150/ DSTK 221	DSTK 202/ DSTK 229	DSTK 160	Connected to DSTA 156 via signal cable	Connected to DSTA 156B via signal cable	DSTK 186 or DSTK 160 / DSTK 225	DSTK 225
Process connection	16 signal leads 16 return leads 16 fused 24V supply	32 signal leads 11 return leads or 1 return lead	32 (16 x 2) 6 fused 24 V supply	24 8 +(8 x 2) 6 fused 24 V supply	32 signal leads 16 fused 24V supply	48 (16x3)	64 (31 x 2) + 2 16 current return leads to ground.	28 (14 x 2) signal leads 6(8 x 2) leads for connection of transducer current	28 (14 x 2) To DSTA 156: 34 (14 x 2) +2 2 Supply 2 Screen	32 (14 x 2) + 4 aux. To DSTA 156B 34 (14 x 2) +2 (CJT) 2 Supply 2 Screen	34 (14 x 2) +2 (CJT) 2 Supply 2 Screen	32 (14 x 2) +2 (CJT) 2 Supply 2 Screen
Width	240 mm	240 mm	240 mm	240 mm	240 mm	470 mm	240 mm	240 mm	240 mm	160 mm	240 mm	120 mm
Cable area (screw terminals)	0.5 - 2.5 mm^2											

1) This is an Object Oriented Connection Unit.

5.2.5.1 Connection to the Process (Current/Voltage Signals)

Examples of connections of standard current and voltage signals are shown below.

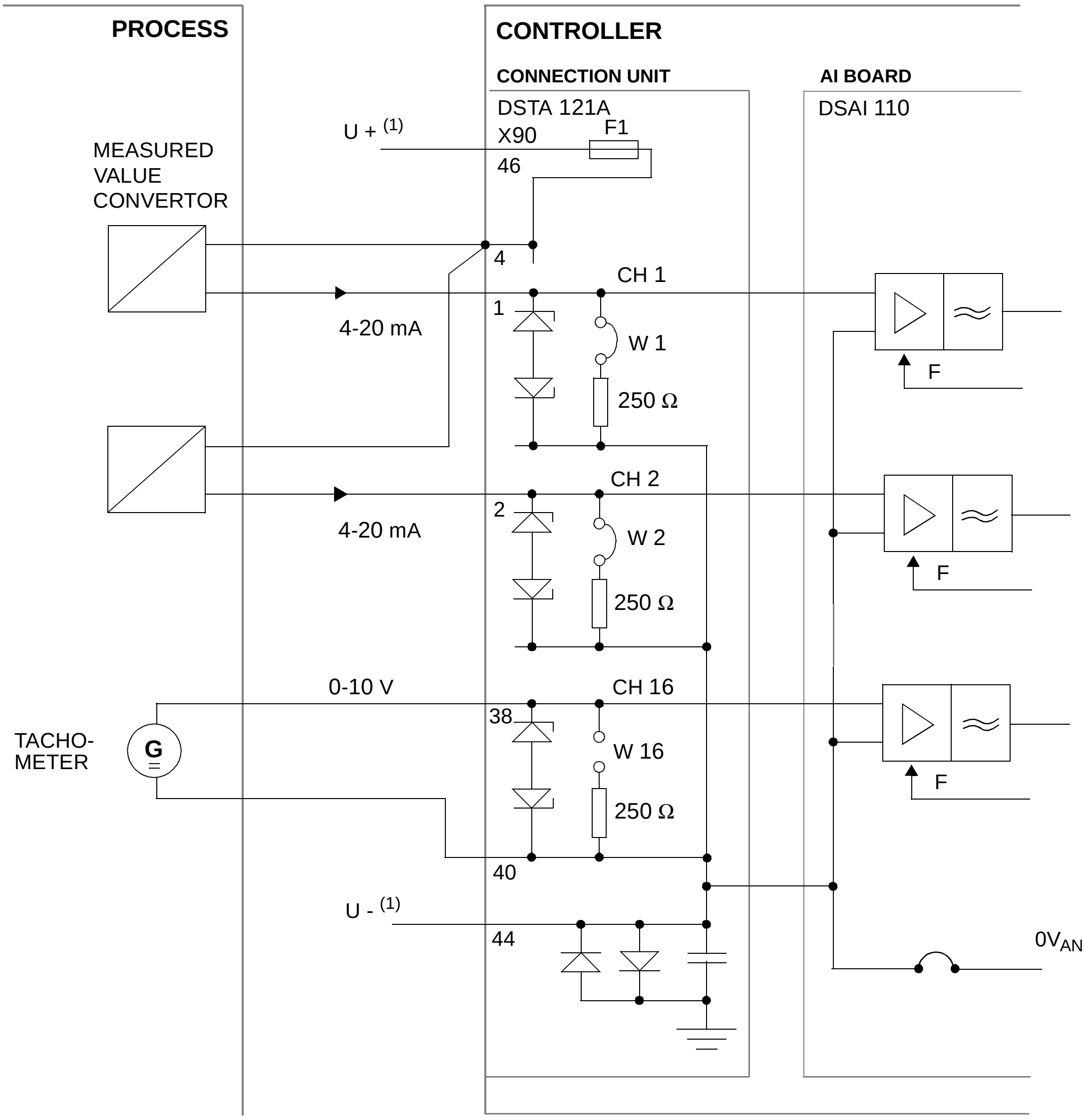


Figure 5-11. Example of Connection of AI Board DSAI 110

1) U+, U-: non-grounded voltage supply unit.

Channels 1 and 2 in Figure 5-11 are connected to measured value converters for current signals, whereas channel 16 is connected for a voltage signal (250 ohm shunt disconnected).

The connection unit DSTA 121A, which is used for DSAI 110, is provided with screw terminals enabling you to connect 32 analog input signals.

NOTE

> DSAI 110 require single-ended inputs, the signal circuit must be grounded at the connection unit. This means that the supply for the current transducer or the floating signal source (with a voltage signal) is grounded at the connection unit DSTA 121A.

Figure 5-12 shows an example of the connections for the AI board DSAI 130A with differential inputs. If necessary, the 0 V-side can be grounded at the measured value converter.
The connection unit DSTA 135, used together with DSAI 130A, is provided with screw terminals for 16 differential analog inputs and 16 short circuit protected transmitter power supplies.

Figure 5-13 shows an example of the connections for the AI board DSAI 130/DSAI 130A with differential inputs. If necessary, the 0 V-side can be grounded at the measured value converter. The connection unit DSTA 131, used together with DSAI 130/DSAI 130A, is provided with screw terminals for 16 differential analog inputs and 6 fused transmitter power outputs.

Figure 5-14 shows an example of DSAI 130 connected to the process with connection unit DSTA 133. The example illustrates two-, three- and four-wire connections of the measured value converter. The connection unit DSTA 133 has 16 channels. Eight are intended only for two-wire transducer connection and eight are individually adaptable to two-, three- or four-wire transducer connection. In all cases, the transducers can be supplied via a fuse.

For object oriented analog input units refer to Section 5.4 Object Oriented Connection Unit for Analog Signals.

Use the connection unit DSTA 002A together with DSAI 133 and DSTA 002B together with DSTA 133A to connect 16 unipolar, single-ended current or voltage signals.

Two DSTA 002A or DSTA 002B, (32 channels), are used together with DSAI 133 or DSAI 133A. You can connect the connection unit to two DSAI 133 or DSAI 133A for redundancy. Each channel has a voltage output, fused with a PTC resistor, for transducer supply. An example of DSAI 133 or DSAI 133A connected to the process with the connection unit DSTA 002A or DSTA 002B is shown in Figure 5-15.

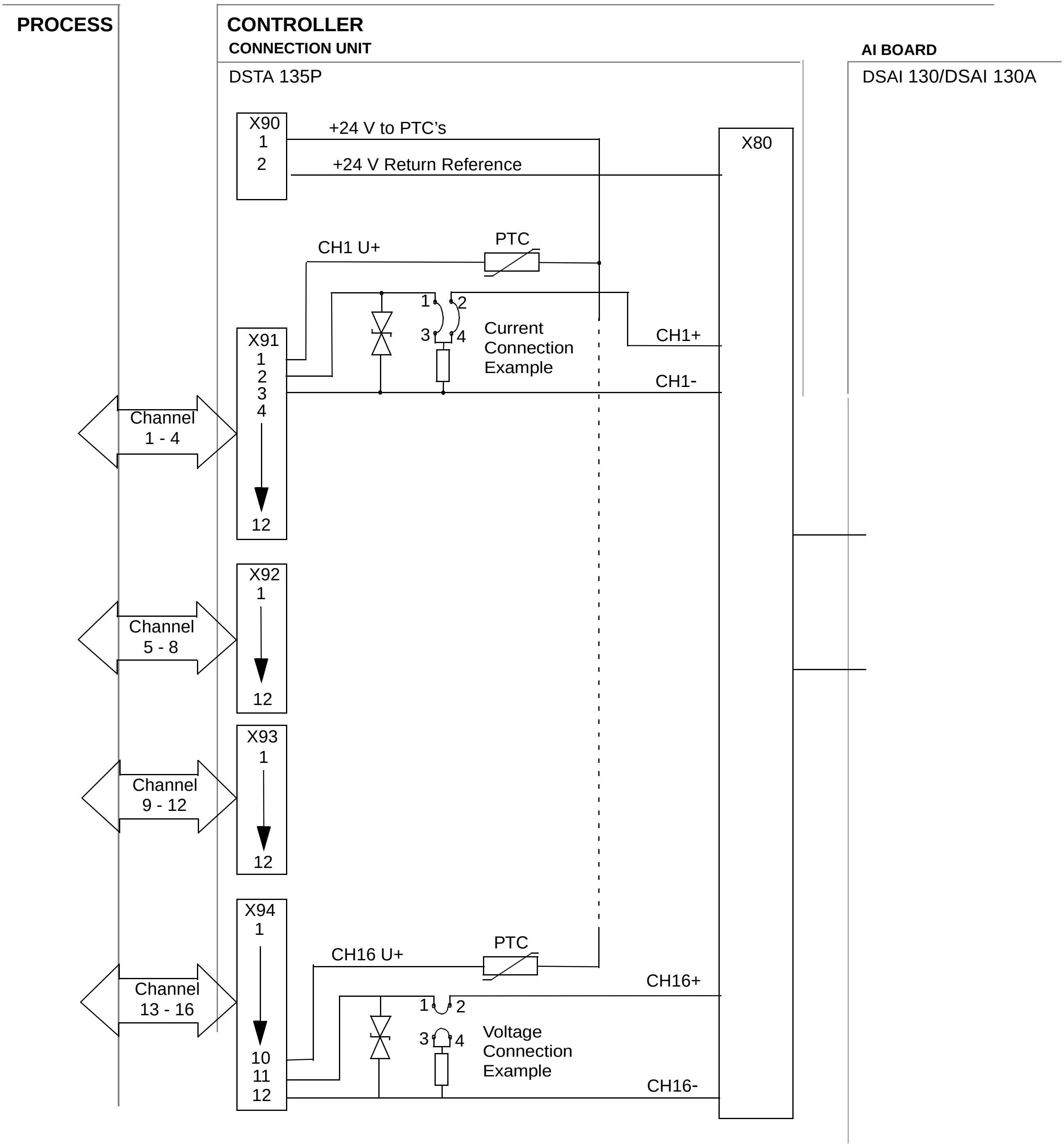


Figure 5-12. Example of Connection of AI Board DSAI 130 with DSTA 135

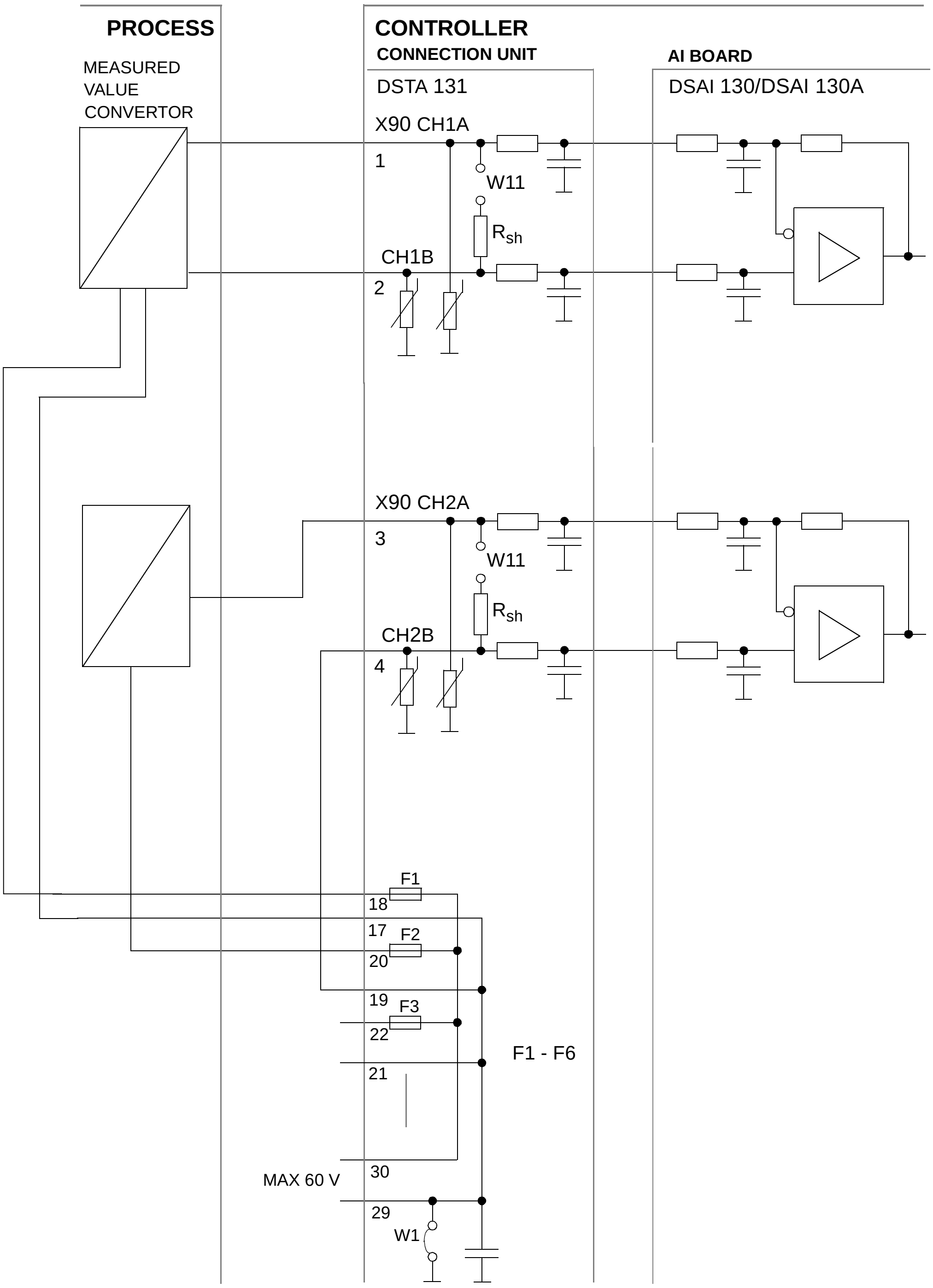
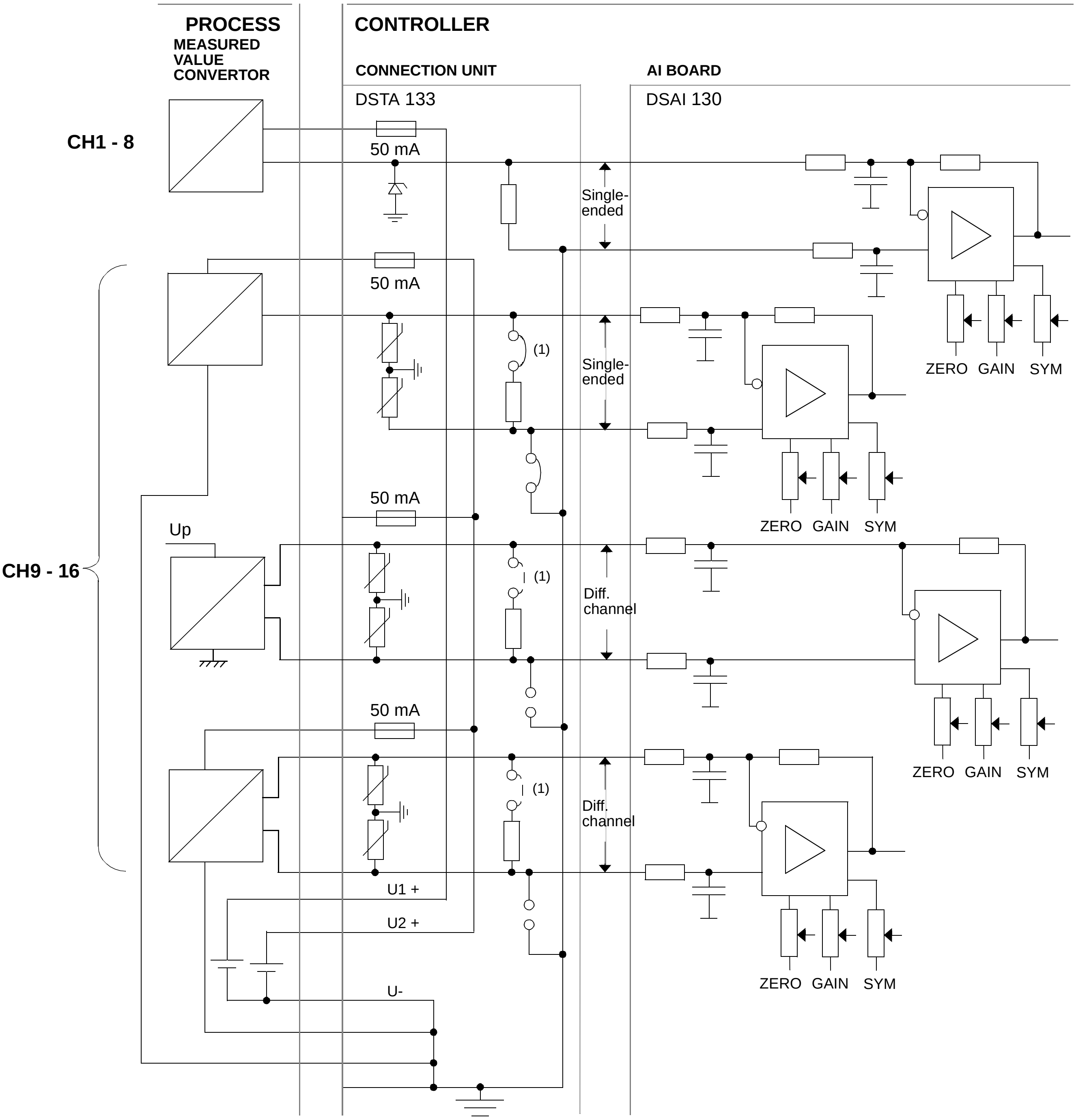


Figure 5-13. Example of Connection of AI Board DSAI 130/DSAI 130A



1) Current signal (with jumper), Voltage signal (without jumper)

Figure 5-14. Connection Example, AI board DSAI 130 for Two-, Three- and Four-Wire Connection of Measured Value Converter

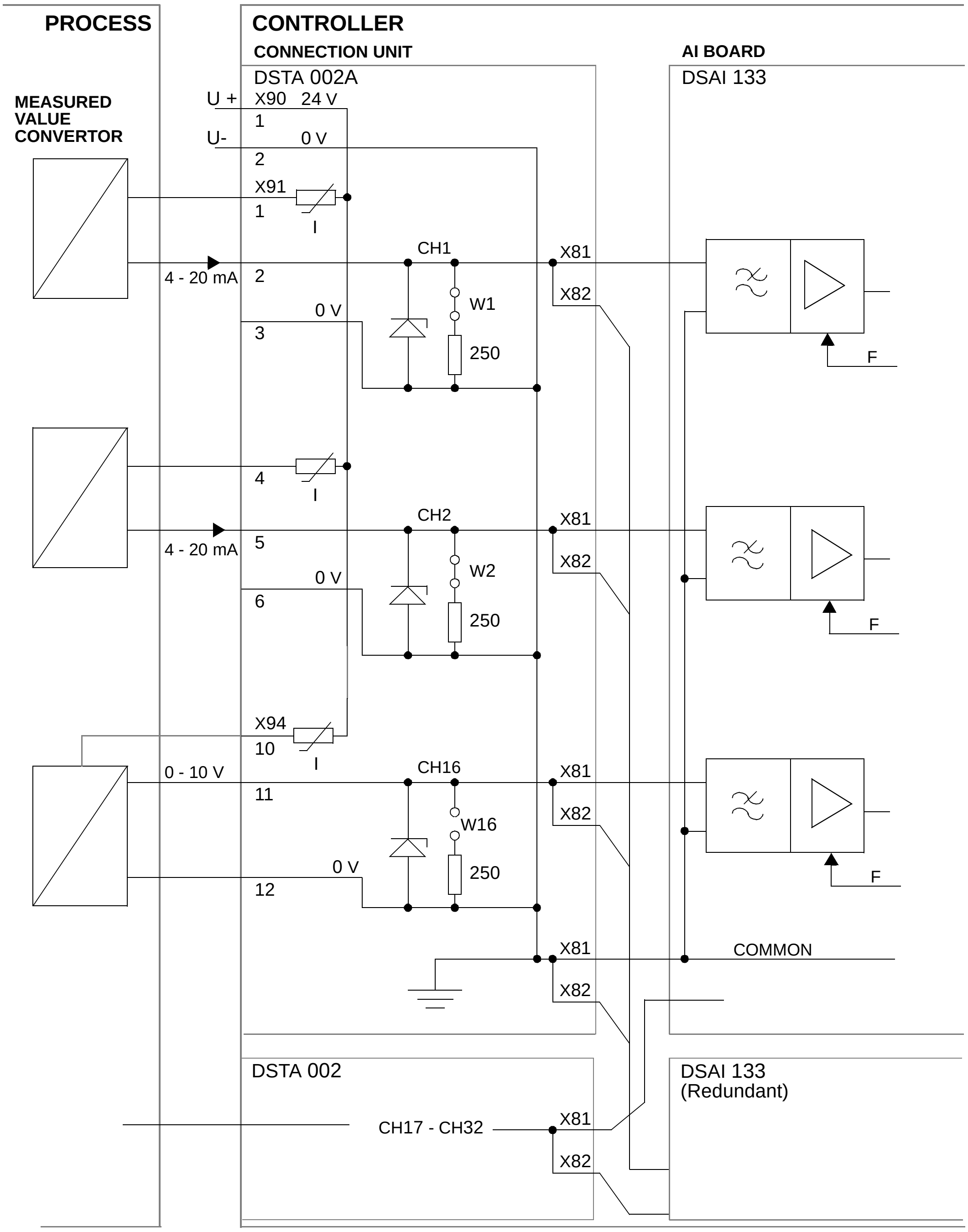


Figure 5-15. Example of Single and Redundant Connections between DSTA 002A and DSAI 133

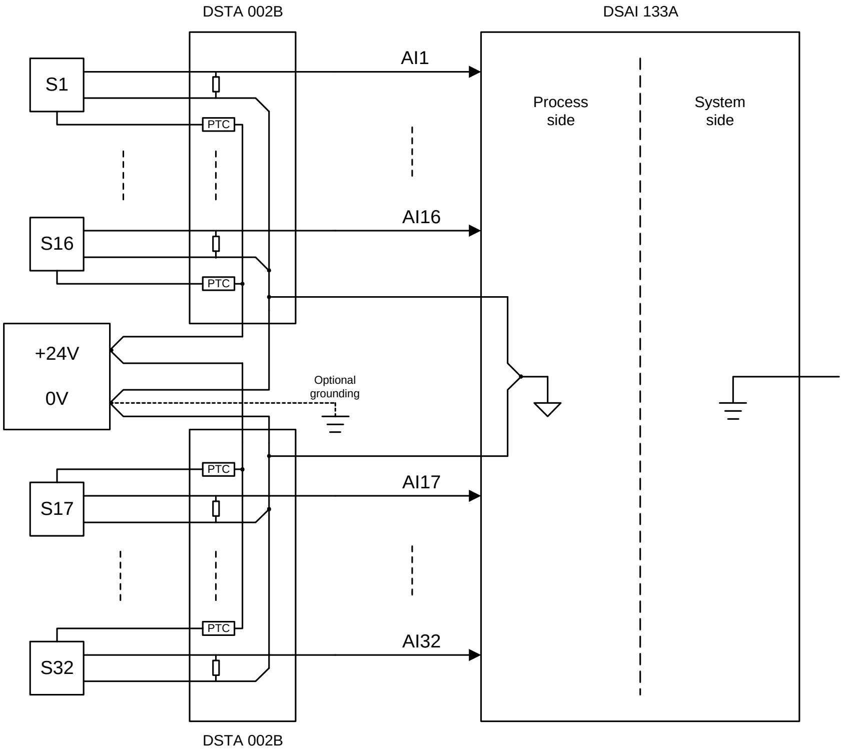


Figure 5-16. Example of Single and Redundant Connections between DSTA 002B and DSAI 133A

5.2.5.2 Connection to the Process (Temperature Measurement)

Four examples of temperature measurement connections are shown below. You can use two types of boards with temperature measurement using resistance thermometers (Pt 100):

- DSAI 145, DSAI 146, which is intended for three-wire connections
- DSAI 151, which is intended for four-wire connections.

Use the DSAI 155, DSAI 155A for temperature measurement using thermocouples.

The DSAI 145, DSAI 146, see Figure 5-17, has 31 measurement channels and one permanently connected reference channel for automatic calibration of the board.

The connection unit DSTA 145, used together with DSAI 145, DSAI 146, has 31 channels for temperature measurement.

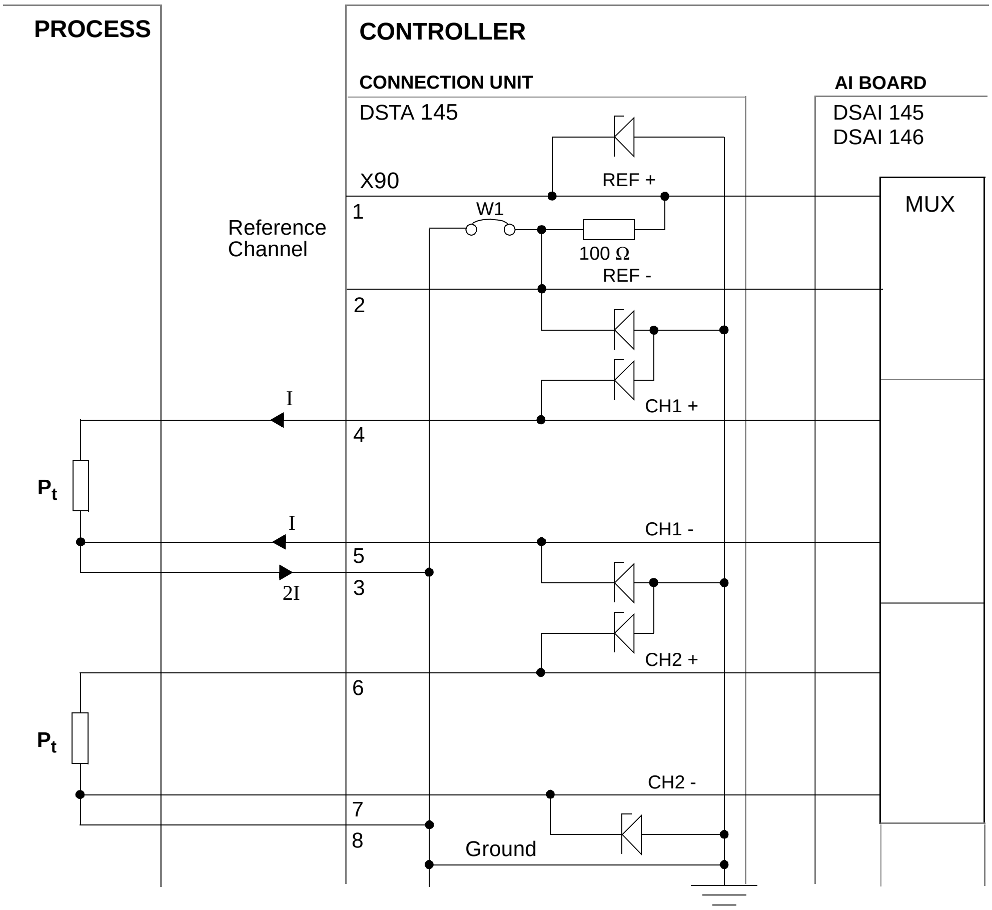


Figure 5-17. Example of Temperature Measurement Using DSAI 145, DSAI 146

NOTE

The reference resistor 100 ohm on DSTA 145 is not used by DSAI 146. DSAI 146 has an on-board reference resistor.

NOTE

Channel REF on DSTA 145 is a reference channel and cannot be used for transducer connection. Unused channels must be connected to ground on the connection unit.

DSAI 151, see Figure 5-18, has two groups of inputs. Each group consists of seven measurement channels. Each group also has a common current generator and a fixed reference channel, for automatic calibration of the board. The connection unit for DSAI 151 is DSTA 151.

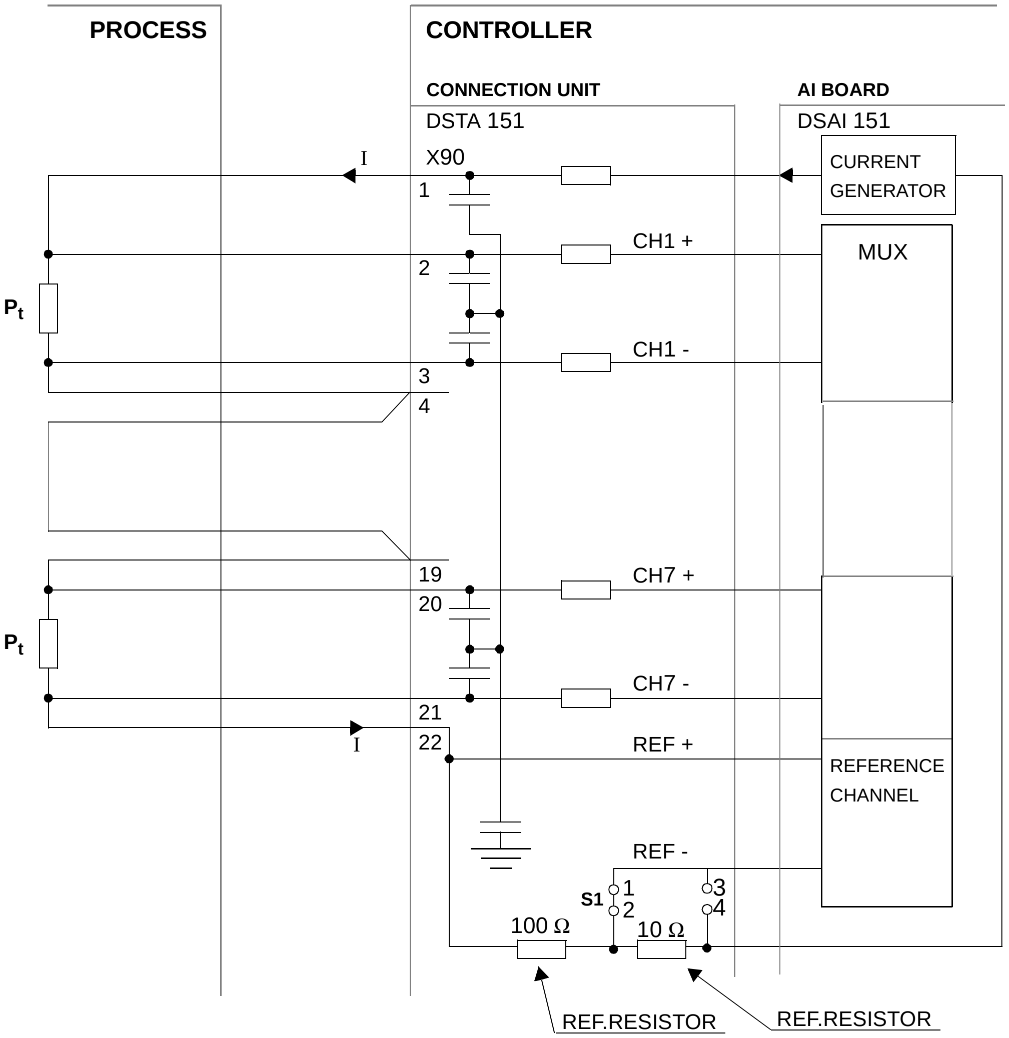


Figure 5-18. Example of Temperature Measurement Using DSAI 151

NOTE

REF-channel on DSTA 151 is a reference channel and cannot be used for transducer connection. Unused channels must be connected to the current loop on the connection unit.

The board DSAI 155/DSAI 155A has 14 differential input channels for low level signals from thermocouples, one channel for temperature measurement of the cold junction on DSTA 155/ DSTA 155P and two reference channels on DSTA 156 (only used on DSAI 155. DSAI 155A have two internal reference channels) for automatic adjustment of the board.

Use the connection unit (CJT-unit) DSTA 155/DSTA 155P for the connection of thermocouples. DSTA 155 and DSTA 155P is normally located out in the process in a suitable enclosure, eliminating the need for an expensive compensation cable. It is possible, however, to install a DSTA 155/DSTA 155P inside the controller cabinet, but then you must draw compensation cables from the thermocouples to the cabinet[1]. In both cases, the temperature at the cold junction (CJT) is measured in the CJT connection unit. This temperature is used in the controller software for compensation of the temperature at the cold junction. The cold Junction transducer have a sensitivity of 100mV/°C and a range of -40 to +100 °C.

Use ordinary signal cable (twisted pair screened multiconductor cable) between the connection units DSTA 155/DSTA 155P and DSTA 156, DSWTA 156B. Use screened ribbon cable DSTK 160, DSTK 186 or DSTK 225 between the connection unit DSTA 156 or DSTA 156B and the input board DSAI 155, DSAI 155A. Since the signal level is low, it is important that the cable screens be grounded at the correct end. Where the screen is grounded depends on whether or not the thermocouple is grounded. With grounded thermocouples, ground the screen in the process end, and with non-grounded thermocouples, ground the screen in the cabinet via the connection unit DSTA 156/ DSTA 156B.

Examples of connections of DSAI 155/DSAI 155A to the connection unit DSTA 155/ DSTA 155P, located out in the process, are shown below with non-grounded and grounded thermocouples.

---

[1] DSTA 155P has an auxiliary connector for ribbon cable connection.

Non-grounded Thermocouple

If no thermocouple connected to the same connection unit is grounded, then make the connection as shown in Figure 5-20.

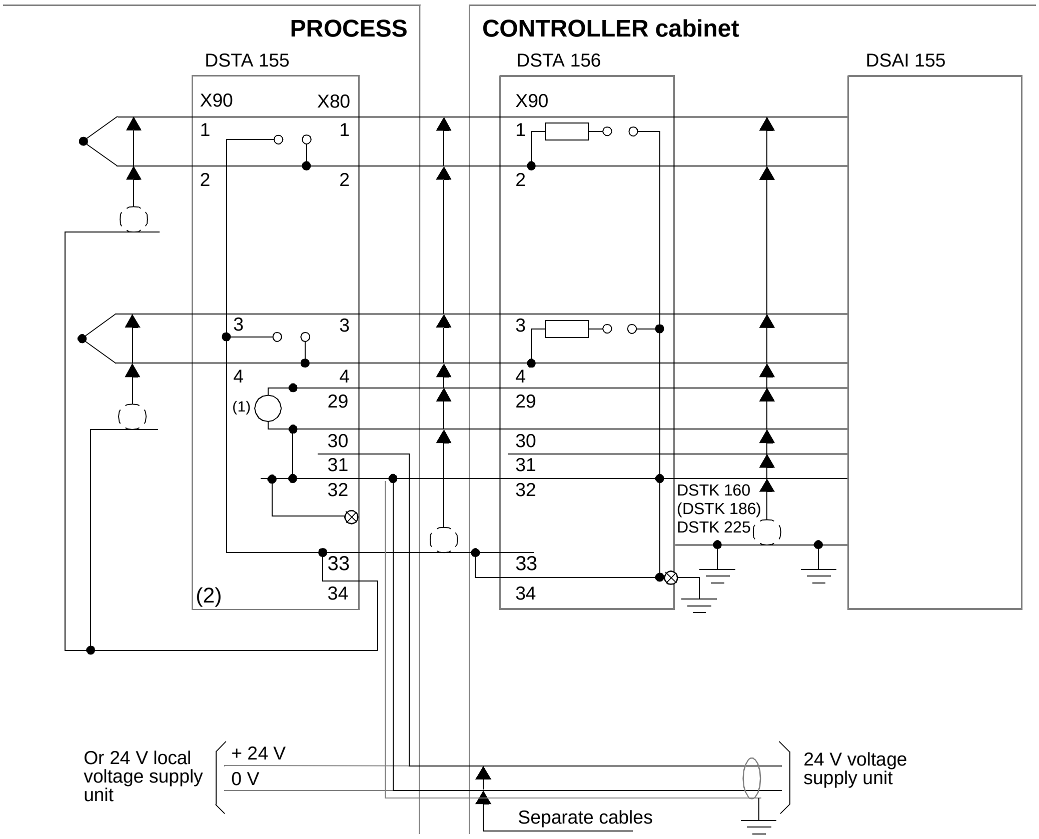


Figure 5-19. Example of Temperature Measurement Using DSAI 155/DSAI 155A and Non-grounded Thermocouples

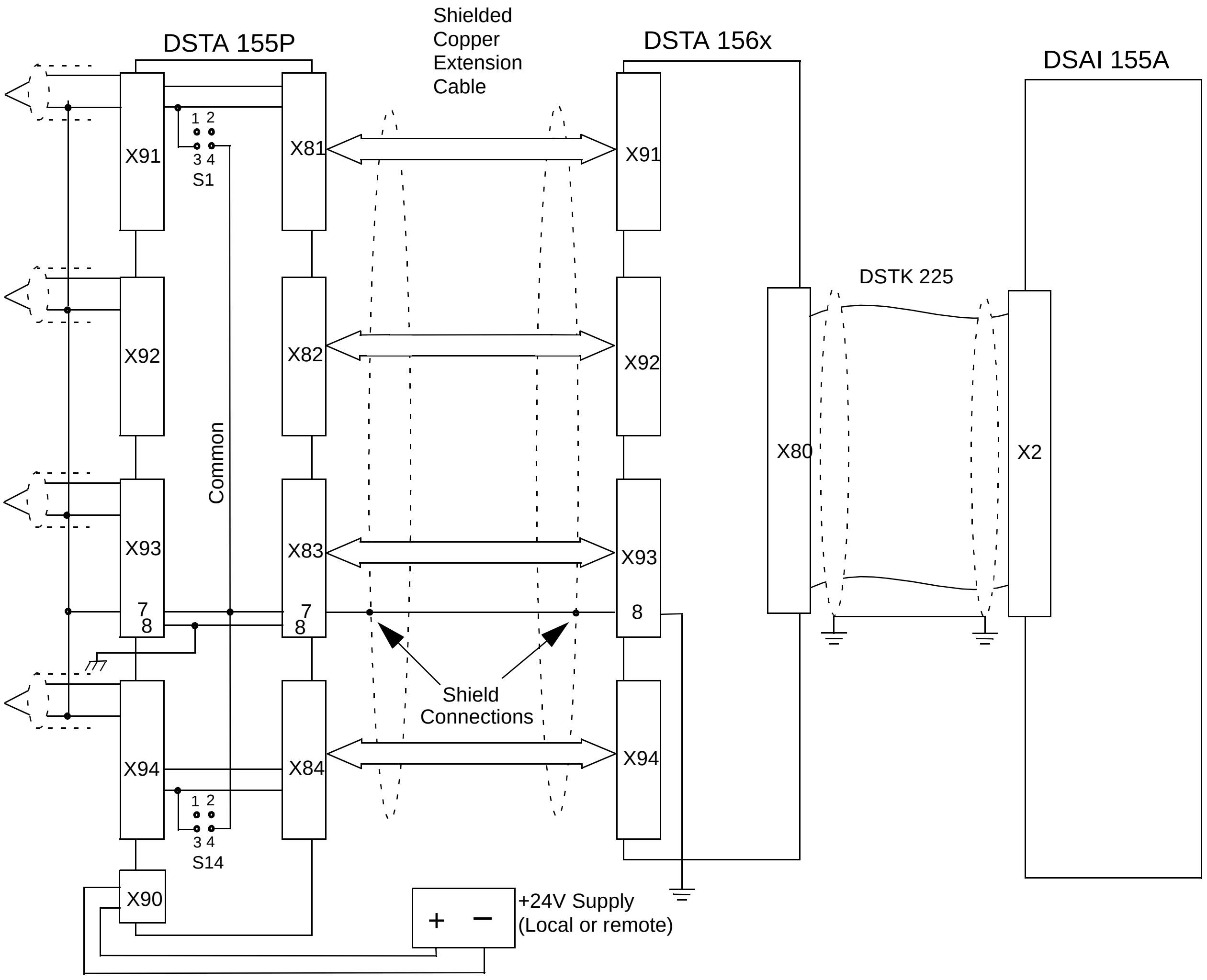


Figure 5-20. Example of Temperature Measurement Using DSAI 155/DSAI 155A and Non-grounded Thermocouples

Remove the jumpers for all 14 channels on the CJT-connection unit DSTA 155.
DSTA 156/ DSTA 156B's solder jumpers are cut on all used channels when DSTA 155 is used. Short-circuit unused thermocouple inputs on the connection terminal blocks on DSTA 156/ DSTA 156B. The solder jumpers on DSTA 156/ DSTA 156B must remain intact for unused input channels to obtain the necessary grounding.

NOTE

You must short-circuit unused inputs. The solder jumpers on DSTA 156/ DSTA 156B must remain for the channels concerned.

Ground incoming cable screens in the cabinet via the connection unit DSTA 156/ DSTA 156B. In this case, do not ground the screens of the compensation cables for thermocouples in the process. Connect them instead to the cabinet ground via the cable screen between DSTA 155, DSTA 155P and DSTA 156/ DSTA 156B.

Grounded Thermocouple

If any thermocouple is grounded, then you must either ground all thermocouples connected to the same connection unit (DSTA 155/DSTA 155P) or ground the non-grounded thermocouples in the thermocouple connection header. If this is not possible, you can do the grounding in the connection unit DSTA 155/DSTA 155P with solder jumpers for the different channels.

NOTE

These three ground points (thermocouple ground point, connection header and the DSTA 155/DSTA 155P ground) **must have the same ground potential**. The potential difference between these ground points and the grounding plane in the controller cabinet may not exceed the CMV of the analog input board. DSTA 155 can not be used for grounded thermocouples.

Ground the cable screen in the connection unit DSTA 155 in accordance with the following Figure 5-21 and Figure 5-22.

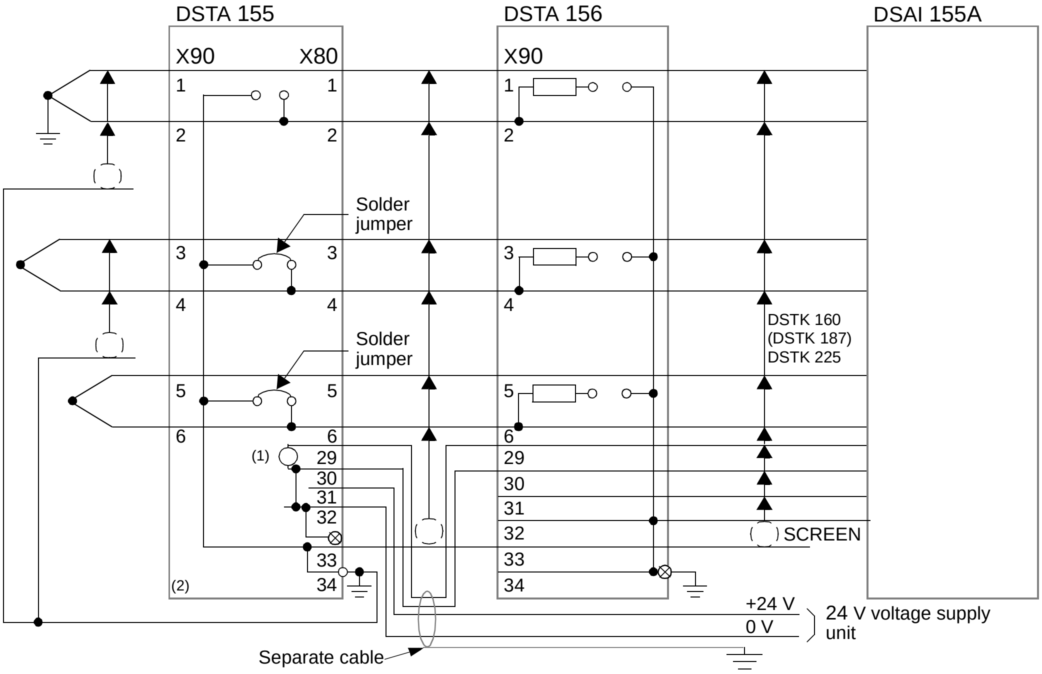


Figure 5-21. Example of Temperature Measurement Using DSAI 155A and Grounded Thermocouples

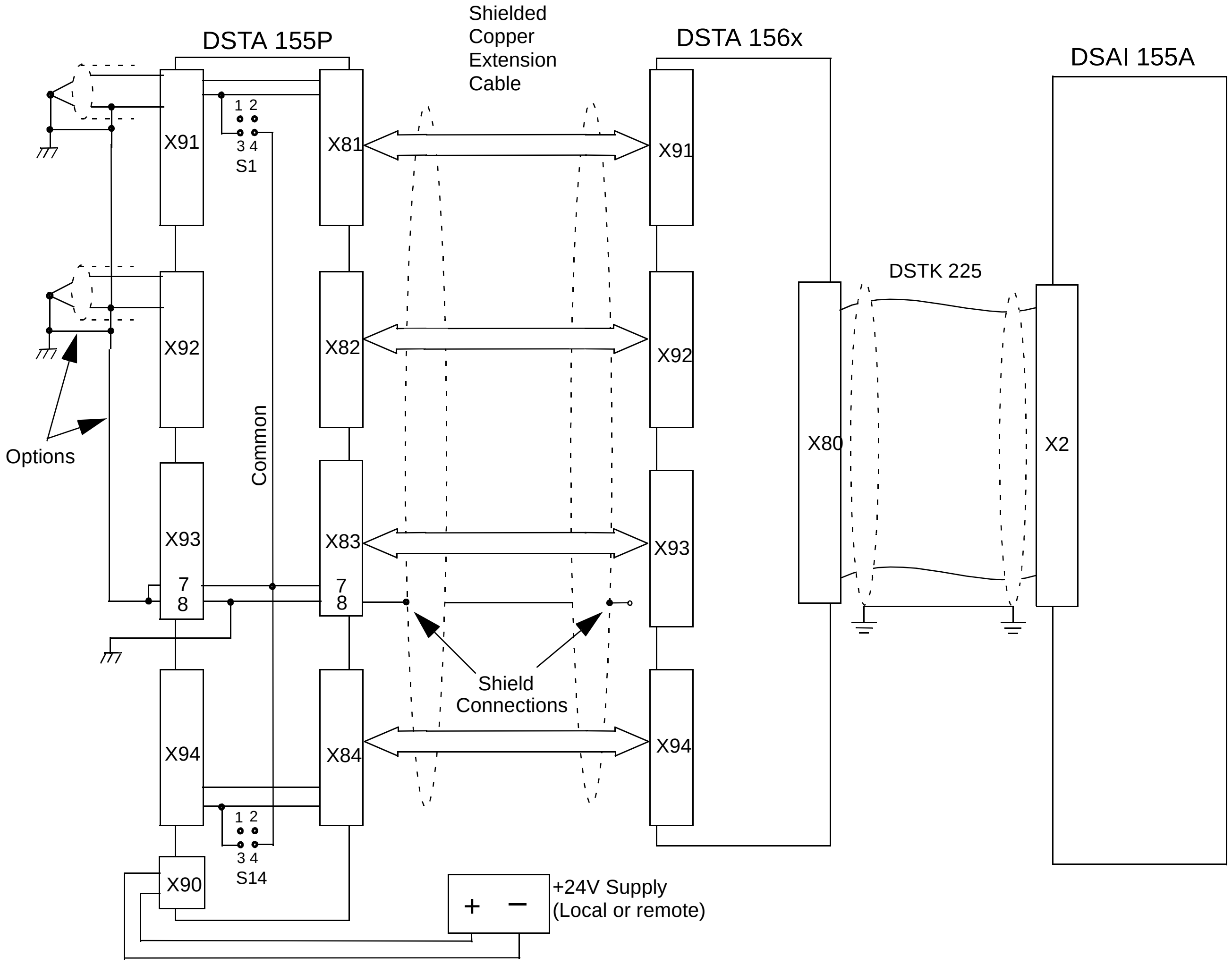


Figure 5-22. Field connection example DSTA 155P with Grounded Thermocouples

NOTE

> The board has 14 channels for temperature measurement plus two reference channels and one channel for the cold junction. You cannot connect the reference channels and the cold junction channel to external transducers.

DSTA 156’s solder jumpers are normally cut when DSTA 155 is used. Short-circuit unused thermocouple inputs on the connection terminal blocks on DSTA 156/DSTA 156B. DSTA 156’s solder jumpers must remain intact for unused input channels to obtain the necessary grounding.

NOTE

> You must short-circuit unused inputs. The solder jumpers on DSTA 156/ DSTA 156B must remain for the channels concerned.

The screens of the thermocouples’ compensation cables are grounded out in the process or in DSTA 155/DSTA 155P. To use the same ground point for the cable screen between DSTA 155/ DSTA 155P and DSTA 156/ DSTA 156B, connect the cable screen to the same ground as thermocouples on DSTA 155/ DSTA 155P.

Certain types of non-grounded thermocouples can, over time, reduce their resistance to grounding. At that point, these thermocouples are considered grounded and you should ground the cable screen between DSTA 155/DSTA 155P and DSTA 156/DSTA 156B in DSTA 155/ DSTA 155P. Then ground the thermocouple in the thermocouple connection header or with the jumpers in DSTA 155/DSTA 155P to ensure satisfactory grounding at all temperatures.
Give consideration to the ground potentials in such cases. (See the Notes above.)

5.2.6 Jumpering of Connection Units for AI Boards (DSTA xxx)

The connection units you can use to connect AI boards to the process are listed in Section 5.2 Analog Input Boards (DSAI xxx). Most of the connection units in this group permit you to select different functions by installing/removing appropriate solder jumpers or switches. Table 5-21 and Table 5-22 provide an overview of all switches and solder jumpers on the connection units. The following sections describe them in greater detail.

For object oriented analog units refer to Section 5.4 Object Oriented Connection Unit for Analog Signals.

Table 5-21. Jumpering of Connection Units for AI Boards

Jumper/switch Function	Jumpers/switches for Connection Unit					
	DSTA 002A	**DSTA 002B**	**DSTA 121A**	**DSTA 131**	**DSTA 133**	**DSTA 135**
Selection of current or voltage signal	W1 - W16	S1 - S16	W1 - W32	W11-W161	W9 - W16 W9C-W16C	S1 - S16
Directly grounded/ floating supply voltage to transducer	Grounded	-	-	W1	W17	-

Table 5-22. Jumpering of Connection Units for AI Boards

Jumper/switch Function	Jumpers/switches for Connection Unit				
	DSTA 145	**DSTA 151**	**DSTA 155**	**DSTA 155P**	**DSTA 156**
Connection of return leads with grounded/ non-grounded transducer	-	-	W1 - W14	S1 - S14	W1 - W14
Production test	W1	S1: 1 - 2	W15	-	-

The following eight figures show the location of the strap jumpers on the connection units for AI boards.

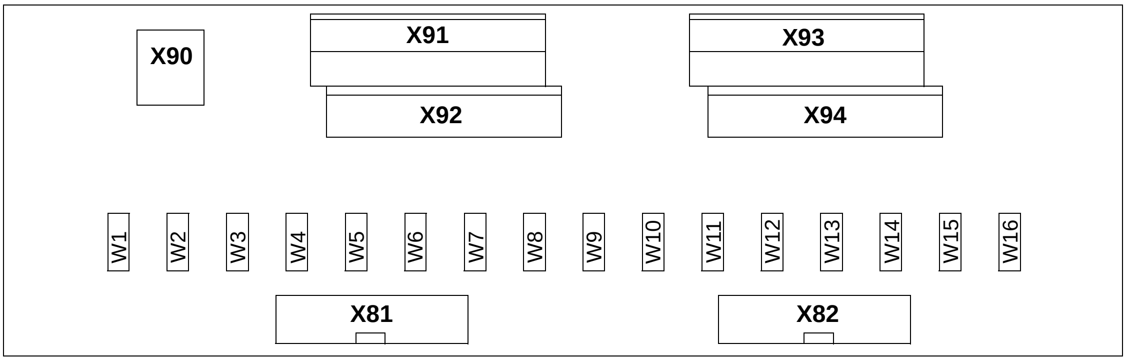


Figure 5-23. Connection Unit DSTA 002A, Location of Solder Jumpers and Connectors

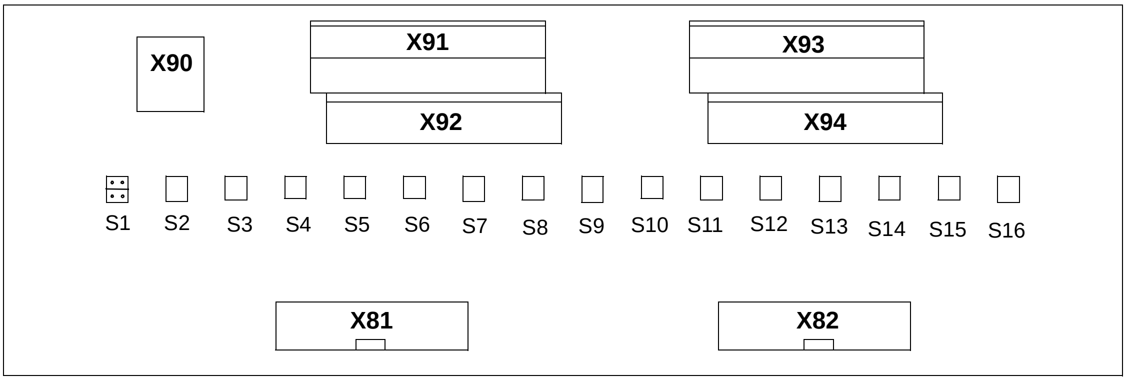


Figure 5-24. Connection Unit DSTA 002B, Location of switches and Connectors

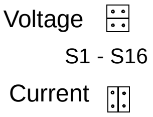
NOTE

X81: Ribbon cable connector from board 1.

X82: Ribbon cable connector from board 2.

X90: External supply for sensors.

X91 - X94: Process connector, analog inputs.



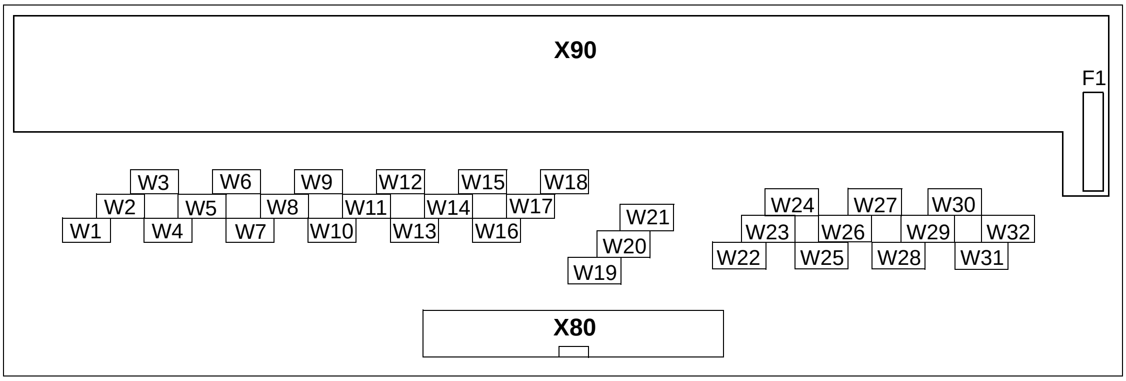


Figure 5-25. Connection Unit DSTA 121A, Location of Solder Jumpers and Connectors

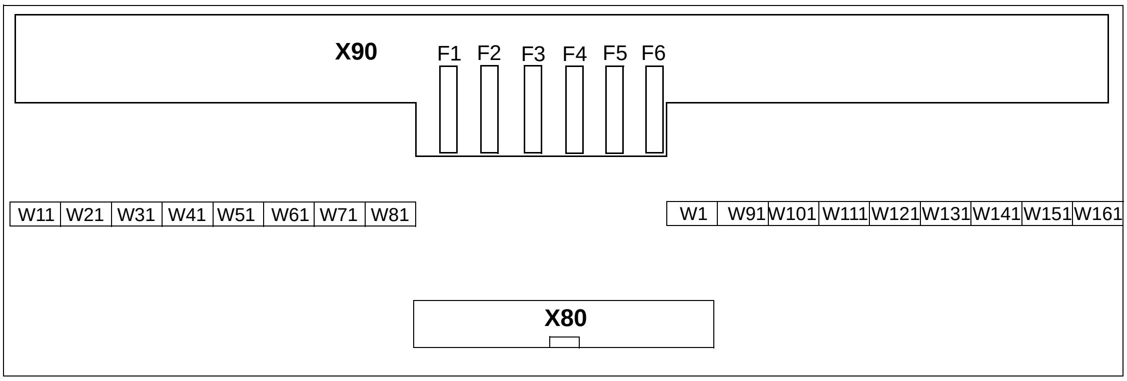


Figure 5-26. Connection Unit DSTA 131, Location of Solder Jumpers and Connectors

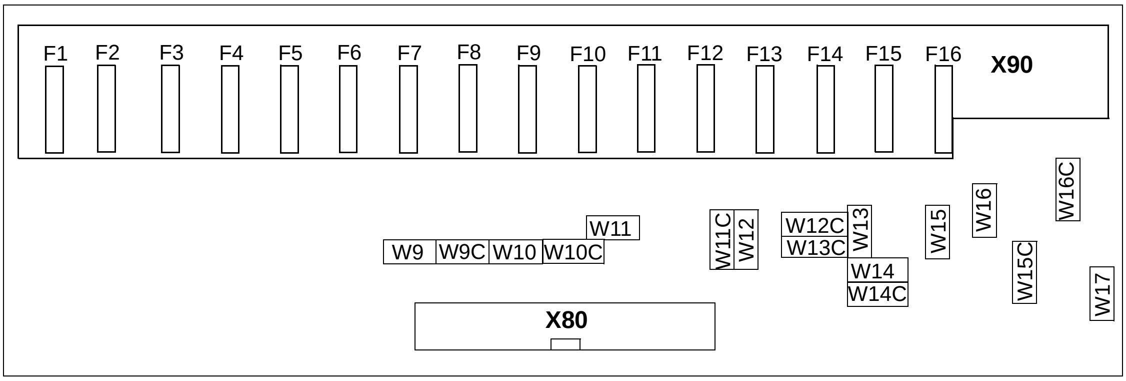


Figure 5-27. Connection Unit DSTA 133, Location of Solder Jumpers and Connectors

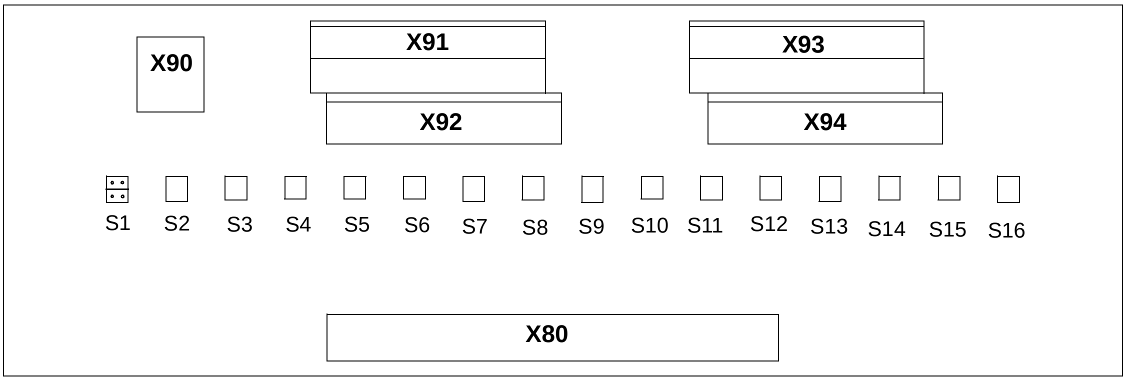
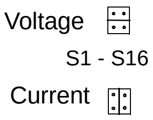


Figure 5-28. Connection Unit DSTA 135, Location of switches and Connectors

Note !



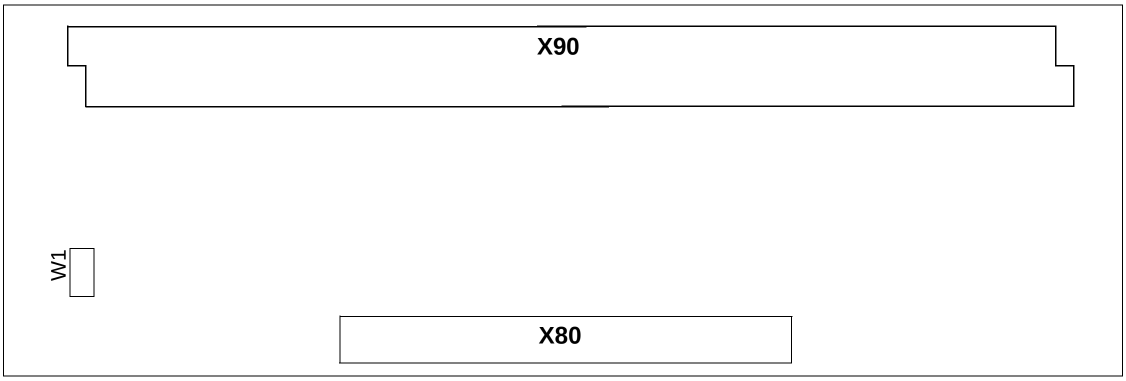


Figure 5-29. Connection Unit DSTA 145, Location of Solder Jumper and Connectors

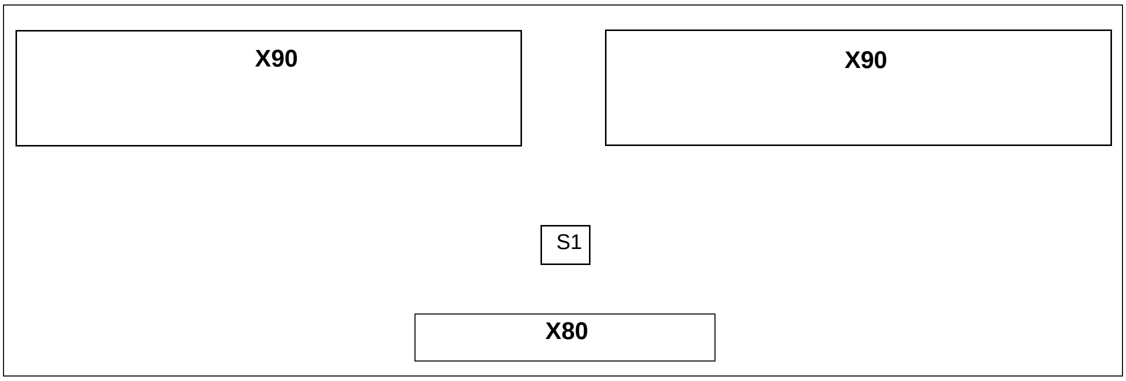


Figure 5-30. Connection Unit DSTA 151, Location of Switch Group and Connectors

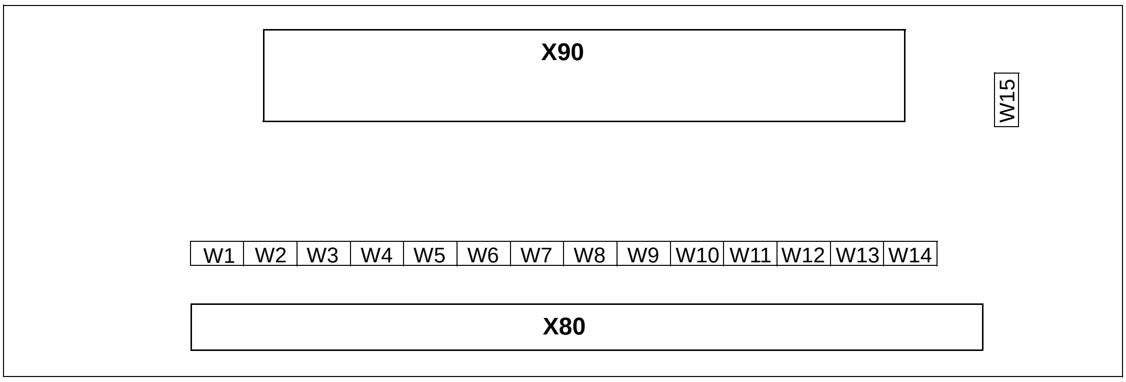


Figure 5-31. Connection Unit DSTA 155 Location of Solder Jumpers and Connectors

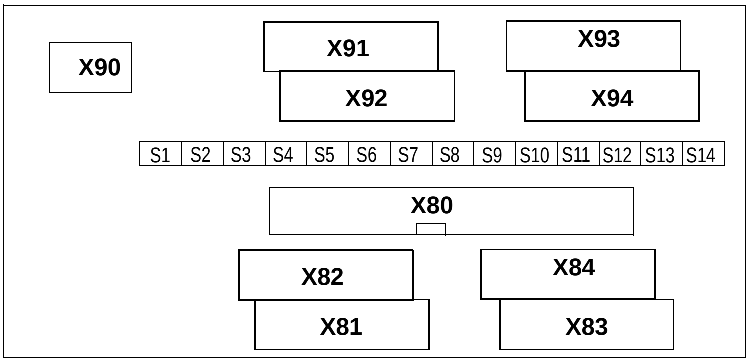


Figure 5-32. Connection Unit DSTA 155P, Location of Jumpers and Connectors

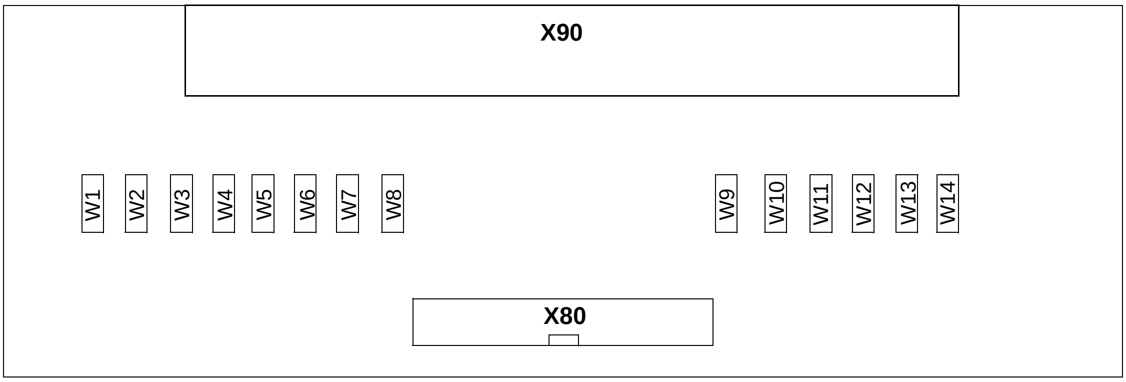


Figure 5-33. Connection Unit DSTA 156, Location of Solder Jumpers and Connectors

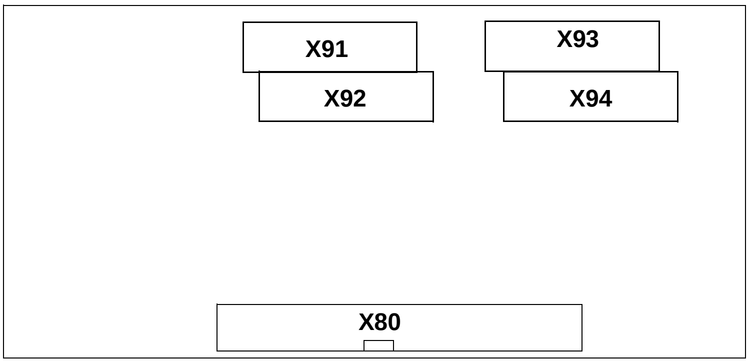


Figure 5-34. Connection Unit DSTA 156B, Location of Connectors

5.2.6.1 Current/Voltage Signal Jumpers/Switches

You can select a current or voltage input signal on the connection units DSTA 002A, DSTA 121A, DSTA 131 and DSTA 133 for each channel using solder jumpers or switches on DSTA 002B and DSTA 135 (see Table 5-23 and Table 5-24 below). To select voltage signal as input to a channel, cut the relevant solder jumper or move the straps. The connection units are delivered with all solder jumpers or straps in place; and the default selection of every channel is current signal.

Table 5-23. Selection of Current or Voltage Signals

Function	**DSTA 002A**	**DSTA 002B**	**DSTA 121A**	**DSTA 131**				**DSTA 135**
	Channel 1 - 16	**Channel 1 - 16**	**Channel 1 - 32**	**Channel 1**	**Channel 2**	**...**	**Channel 16**	**Channel 1 - 16**
	W1 - W16	**S1 - S16**	**W1 - W32**	**W11**	**W21**	**...**	**W161**	**S1 - S16**
Selection of current signal	ON		ON	ON	ON	...	ON	
Selection of voltage signal	OFF		OFF	OFF	OFF	...	OFF	

Table 5-24. Selection of Current or Voltage Signals

Function	**DSTA 133**	
	Channel 9 - 16	
	W9 - W16	**W9C - W16C**
Selection of current signal for externally grounded transducer	ON	OFF
Selection of current signal for non-grounded transducer	ON	ON
Selection of voltage signal	OFF	OFF

NOTE

The DSTA 133 channels 1 - 8 are intended for current signals and non-grounded transducers only.

5.2.6.2 Grounded/Floating Supply Solder Jumpers

You can obtain this function on the connection unit DSTA 131 with the solder jumper W1 and on the DSTA 133 with the solder jumper W17. The solder jumpers are normally in place, which corresponds to directly grounded supply voltage to the transducers. For floating supply voltage, cut the appropriate solder jumpers.

For object oriented unit (DSTA 137/DSTA 138) refer to Section 5.4 Object Oriented Connection Unit for Analog Signals.

5.2.6.3 Return Lead Jumpers for Thermocouples

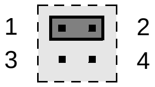
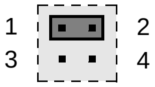
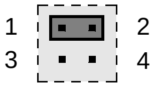
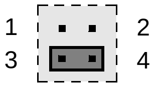
For a correct installation of thermocouples and connection units, it is very important to ground the units properly.

All thermocouples connected to the same connection unit must be connected to the same ground. They should all be either floating (not grounded) or grounded.

If one or more of the thermocouples are grounded in the process, but not all of them, then you must ground those thermocouples which are floating. Use the jumpers/switches on the DSTA 155/DSTA 155P to accomplish this. On DSTA 155P the terminals X93:7-8 are then to be connected together on DSTA 155P. See Table 5-25 below.

All unused inputs channels must be short-circuit on DSTA 156/ DSTA 156B or DSTA 155/ DSTA 155P.

Table 5-25. Jumpering of Return Leads with Grounded/Non Grounded Transducers

Connection of the Thermocouples Return Leads		**DSTA 155**	**DSTA 155P**	**DSTA 156/ DSTA 156B**
		Channel 1 - 14	**Channel 1 - 14**	**Channel 1 - 14**
		W1 - W14	**S1 - S14**	**W1 - W14**
All the thermocouples connected to the same connection unit are floating		OFF		OFF
All the thermocouples connected to the same connection unit are grounded		OFF		OFF
Some thermocouples are grounded, not all of them	The thermocouple of the channel is grounded	OFF		OFF
	The thermocouple of the channel is not grounded	ON		OFF
For channels not used		-	-	ON

5.2.6.4 Production Test Jumpers/Switches

The solder jumpers W1 on DSTA 145 and W15 on DSTA 155 are intended for production test purposes only. They should always be in place. The switch group S1 on the connection unit DSTA 151 is used for production tests only. It shall always be set according to Figure 5-35 below.

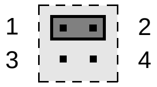


Figure 5-35. Switch S1 on DSTA 151

5.3 Analog Output Boards (DSAO xxx)

Analog boards DSAO 110, DSAO 120/DSAO 120A and DSAO 130/DSAO 130A are all short-circuit-protected. They differ in the number of channels and the insulation of their outputs.

The block diagram for an analog output signal is shown in Figure 5-36.

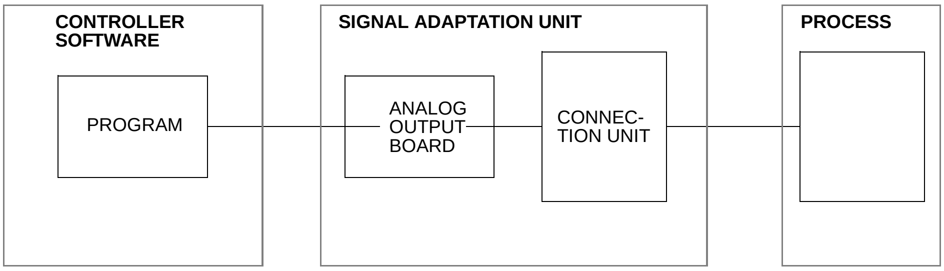


Figure 5-36. Analog Output Signal, Block Diagram

In general, analog output boards function as follows:

The digital signal from the controller software is converted to an analog signal on the AO board in a D/A converter. The signal is adapted to the required current/voltage range in an amplifying circuit.

On board DSAO 110, all four channels are galvanically isolated. Whether the outputs are current or voltage outputs is determined by the location of jumpers on the board. The gain factor of each channel is adjustable via potentiometers in the front.

The board DSAO 120 has eight outputs without galvanic insulation and is provided with front potentiometers for adjustment of the gain factor and the zero point. Current or voltage output is selected by the signal wire connection to the connection unit.

The board DSAO 120A provides 8 bipolar output channels for either Current or Voltage.
Each output channel is galvanically isolated from the system ground as well as from the other (7) channels.

DSAO 130 has 16 outputs and jumpers on the board for selection of current or voltage output. The outputs are not galvanically insulated. **The load connected to the current outputs must be potentially floating.**

The board DSAO 130A provides one group of 16 unipolar output channels for Current.
The group is galvanically isolated from the system ground.

All analog output boards are factory adjusted for current output. When using the voltage output, it may be necessary to readjust the board to obtain the specified accuracy.

Analog Output boards key data are shown in Table 5-26.

Table 5-26. Analog Output Boards, Key Data

Data	**DSAO 110**	**DSAO 120**	**DSAO 120A**	**DSAO 130**	**DSAO 130A**
Number of channels	4	8	8	16	16
Signal range	0 - ±10 V 0 - ±20 mA 0 - ±10 mA	0 - ±10 V 0 - ±20 mA	0 - ±10 V 0 - ±20 mA	0 - +10V 0 - +20 mA 0 - +10 mA	0 - +20 mA
Resolution	12 bits incl. sign	12 bits incl. sign	12 bits + sign	8 bits	12 bits
Galvanic Insulation (600VAC / 850 VDC)	Channel - channel Channel - system	None	channel-chan. channel - syst.	None	channel - syst.
Load (current signal)	≤ 500 Ω @ 20 mA ≤ 1000 Ω @ 10 mA	≤ 500/600 Ω @ 20 mA	≤ 600 Ω	$R \le \frac{(U-5)}{Imax}$ $19V \le U \le 30V$	≤ 850 Ω
Load (voltage signal)	≥ 600 Ω	≥ 2000/1000 Ω	≥ 1 kΩ	≥ 500 Ω	–
Inaccuracy @ +25°C	< 0.05%	< 0.1%	≤ 0.1% at 250Ω 0,2% 0-600 Ω	≤ 0.4%	≤ 0.1%
Temperature drift - Maximum - Typical	0.1%/10°C 0.05%/10°C	0.1%/10°C 0.05%/10°C	0.02%/10°C	0.3%/°C 0.15%/10°C	0.03%/10°C
Current consumption 24 V (max)	450 mA	120 mA	680 mA	420 mA	680 mA
Current consumption 5 V	250 mA	250 mA	350 mA	250 mA	250 mA
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/ NMV2)	yes 5 kV 2.5 kV / 2.5 kV	yes 3 kV 2.5 kV / 2.5 kV	yes 3 kV 2.5 kV / 1.0kV	yes 3 kV 2.5 kV / 2.5 kV	yes 3 kV 2.5 kV / 1.0 kV

1) 16 object with one analog Output on each object
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
3) This is an Object Oriented Connection Unit.

5.3.1 Front Panels

Figure 5-37 shows the front panel of DSAO 110 and DSAO 130.

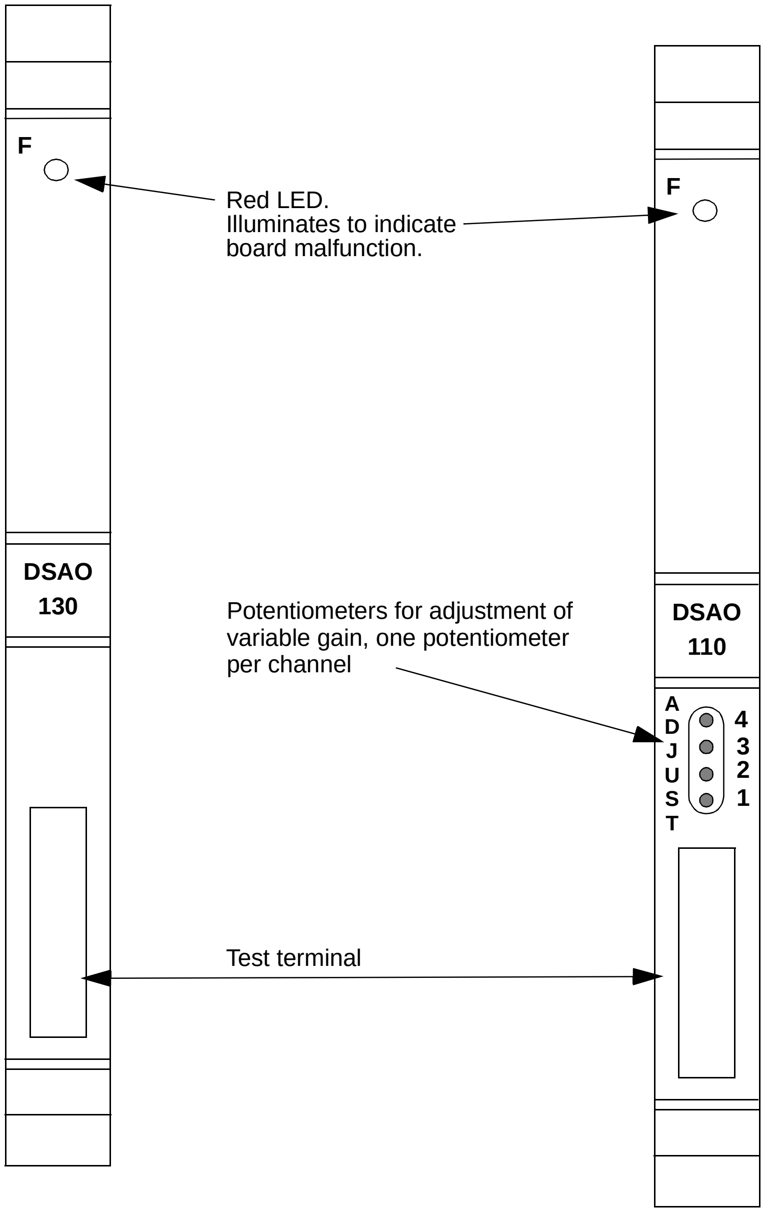

F
Red LED.
Illuminates to indicate board malfunction.
F
DSAO 130
Potentiometers for adjustment of variable gain, one potentiometer per channel
DSAO 110
ADJUST
4
3
2
1
Test terminal

Figure 5-37. Front Panel of DSAO 130 and DSAO 110

The following figure shows the front panel of DSAO 120 and DSAO 120A/DSAO 130A.

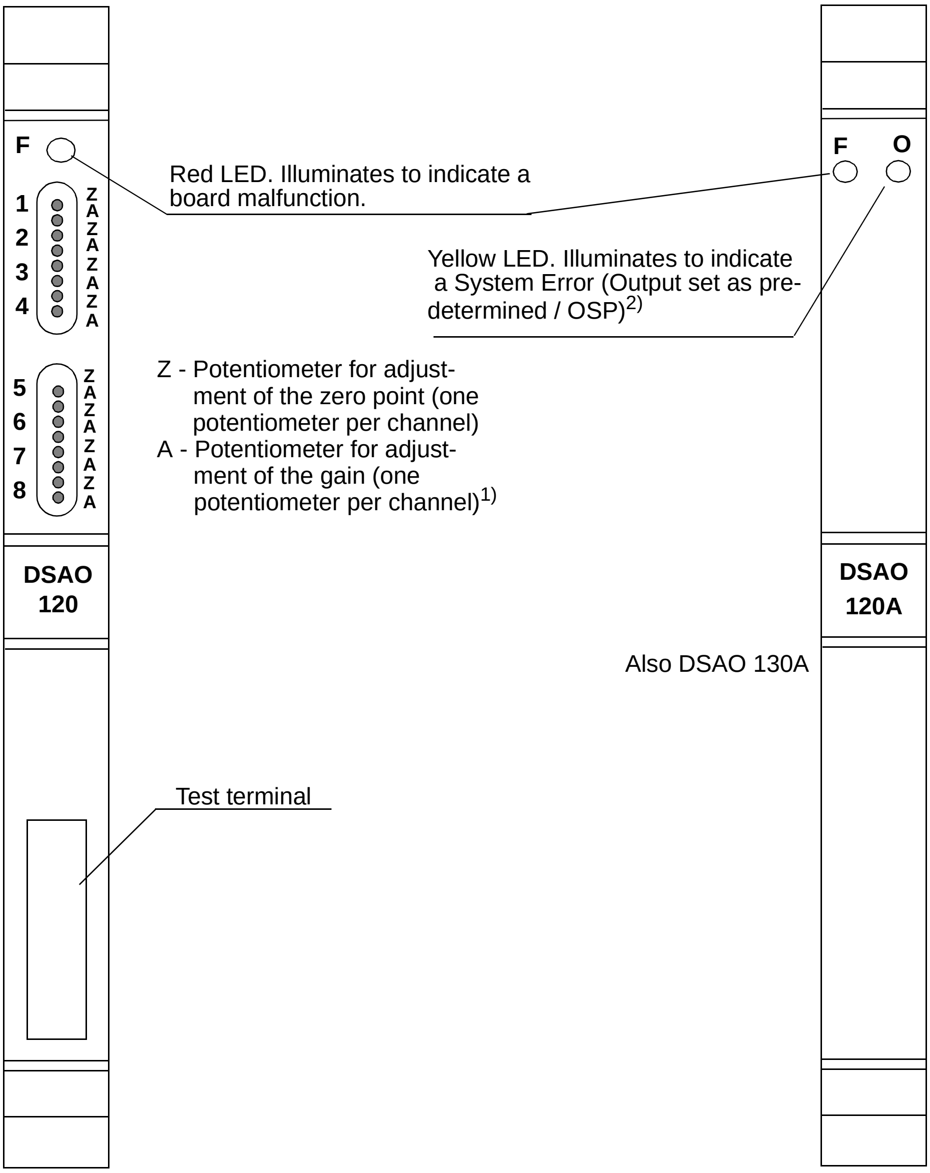

F
1
2
3
4
5
6
7
8
Z
A
Z
A
Z
A
Z
A
Z
A
Z
A
Z
A
Z
A
DSAO 120
F
O
DSAO 120A
Red LED. Illuminates to indicate a board malfunction.
Yellow LED. Illuminates to indicate a System Error (Output set as pre-determined / OSP)2)
Z - Potentiometer for adjustment of the zero point (one potentiometer per channel)
A - Potentiometer for adjustment of the gain (one potentiometer per channel)1)
Also DSAO 130A
Test terminal

Figure 5-38. Front Panel of DSAO 120 and DSAO 120A/DSAO 130A

1) In some documentation, this potentiometer can be called G or Gain.
2) OSP Not supported by system SW

5.3.2 Jumpering of AO Boards

Analog output boards are jumpered for different functions, as shown in Table 5-27 below. The following sections describe these jumper/switch groups in detail.

Table 5-27. Jumpering of AO Boards

Jumper/Switch Function	**Jumper/Switch Groups for Each Board**				
	DSAO 110	**DSAO 120**	**DSAO 120A**	**DSAO 130**	**DSAO 130A**
Address	S1				
Selection of current or voltage signal	S102 - S402 (pins 5 ... 8)	-	S2	S10 - S160	No
Selection of 10 or 20 mA current output	W106 - W406	-	No	W10 - W160	No
Selection of operation or test mode	S101 - S401	S2, S10 - S80	No	-	No
Selection of gain factor	S102 - S402 (pins 1 ... 4)	-	FPGA / S2		FPGA
Interruption of INHIB-signal	-	-	X5	-	X5

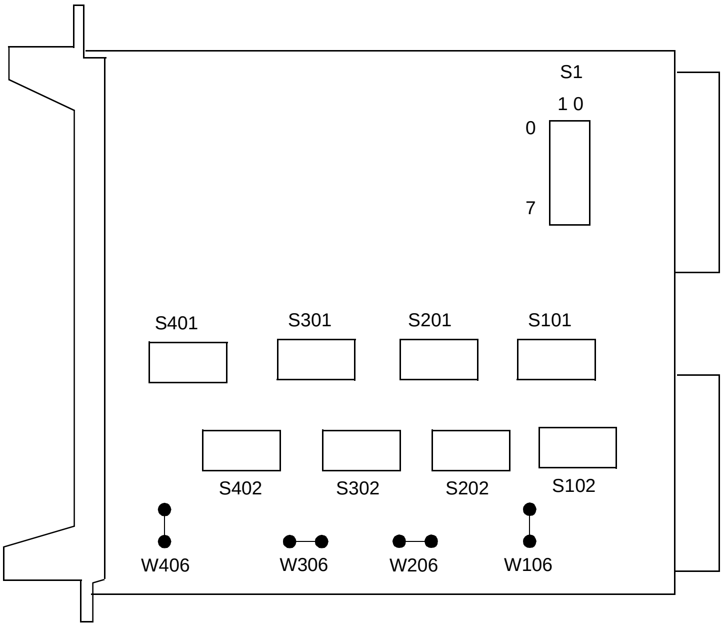


Figure 5-39. Analog Output Board DSAO 110, Location of Jumper Groups

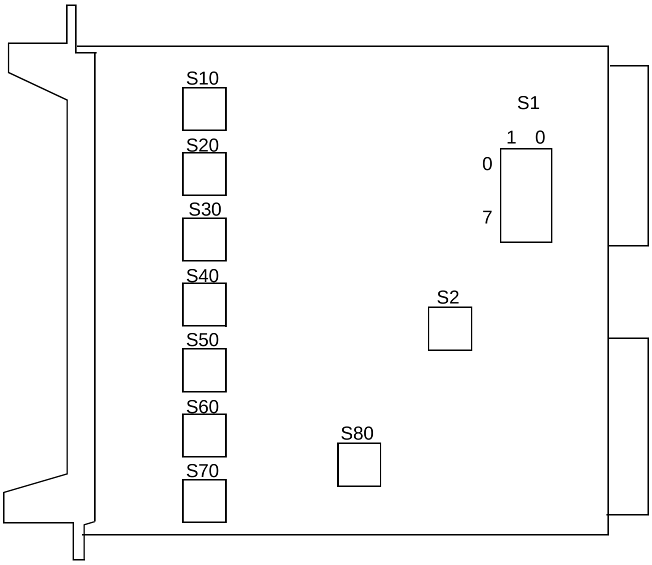


Figure 5-40. Analog Output Board DSAO 120, Location of Switch Groups

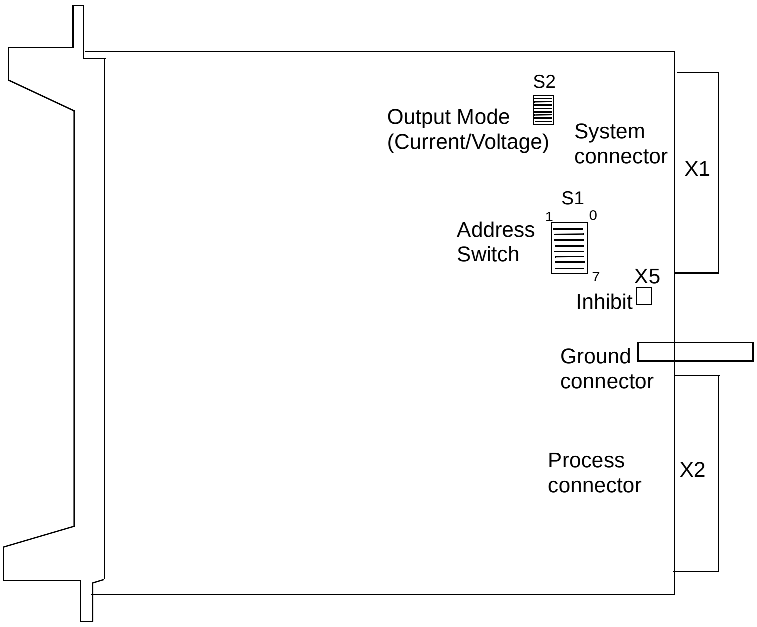


Figure 5-41. Analog Output Boards DSAO 120A
Location of Switch Groups

Inhibit switch

If the Inhibit goes active the normal program execution stops and the outputs deactivate or goes to their predetermined value OSP. Taking the jumper X4 away prevents the board from react on an active Inhibit signal and the output signal will be hold. The jumper shall normally be mounted in normal position.

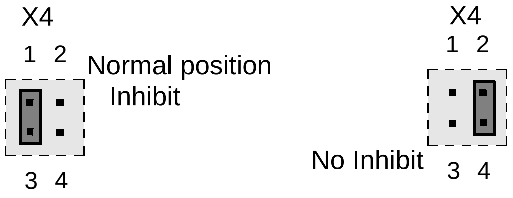


Figure 5-42. Inhibit Switch

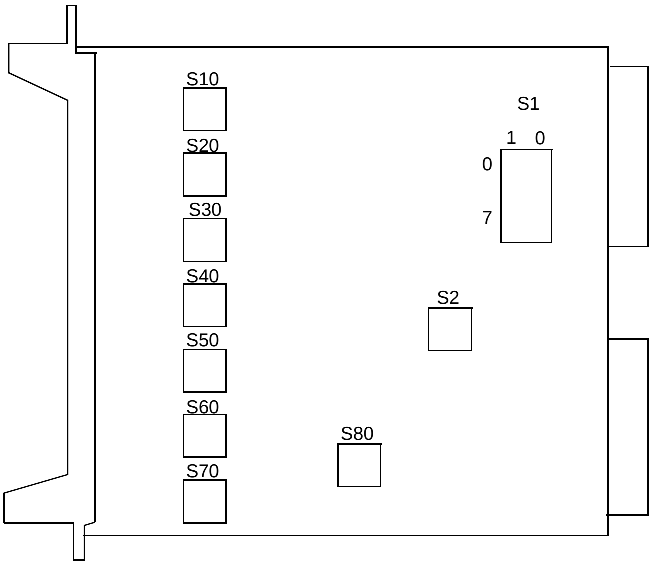


Figure 5-43. Analog Output Board DSAO 120, Location of Switch Groups

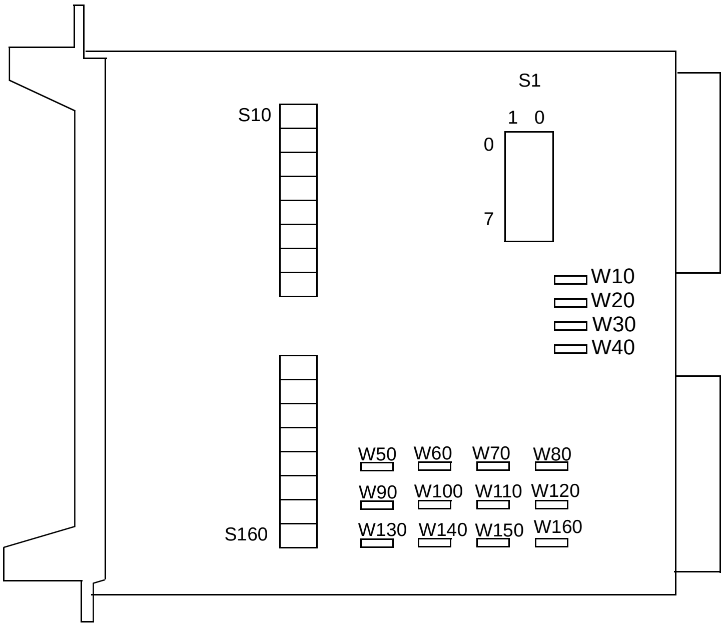


Figure 5-44. Analog Output Board DSAO 130, Location of Jumper Groups

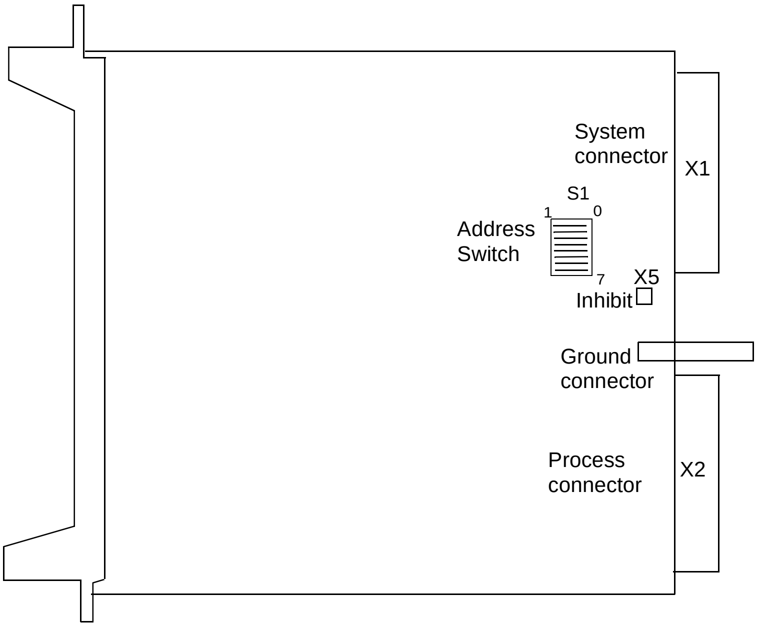


Figure 5-45. Analog Output Boards DSAO 130A
Location of Switch Groups

5.3.2.1 Address Switch

The board address is set on switch group S1. The address range for the analog output board is H’40 - H’5F (hexadecimal notation), which corresponds to the range 64 - 95 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

5.3.2.2 Current/Voltage Signal Jumpers

You can select a current or voltage output signal on the boards DSAO 110 and DSAO 130 using jumpers. In the DSAO 120A, all channels are both current and voltage outputs. The calibration for current or voltage) is selected by means of Output Mode Switch S2. The function is selected by the connection to the connection unit (also see Table 5-27).

The tables below show the switch used in DSAO 110 and DSAO 130.

Table 5-28. Selection of Current/Voltage Signals for DSAO 110

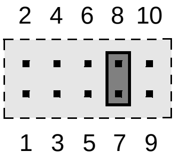
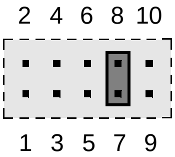
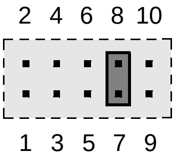
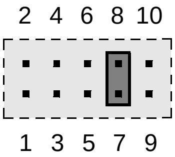
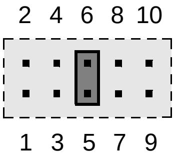
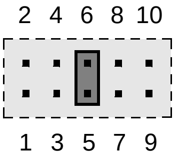
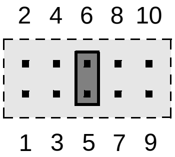
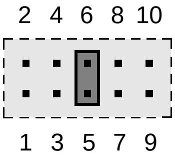
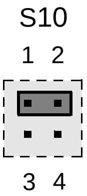
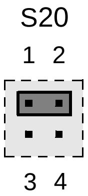
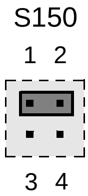
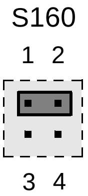
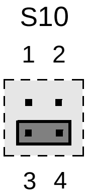
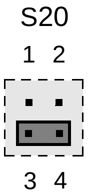
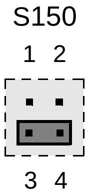
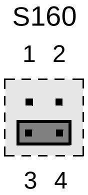
Function	**DSAO 110**			
	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
Selection of current signal	S102 	S202 	S302 	S402 
Selection of voltage signal	S102 	S202 	S302 	S402 

Table 5-29. Selection of Current/Voltage Signals for DSAO 130

Function	DSAO 130				
	Channel 1	**Channel 2**	⋮	**Channel 15**	**Channel 16**
Selection of current signal			⋮		
Selection of voltage signal			⋮		

5.3.2.3 10 or 20 mA Current Output Solder Jumpers

You can select current output of 10 or 20 mA on the boards DSAO 110 and DSAO 130 only by means of solder jumpers (see Table 5-27). The solder jumpers for this function are shown in the table below.

Table 5-30. Selection of 10 or 20 mA Current Output

Function	DSAO 110				DSAO 130			
	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**	**Channel 1**	**Channel 2**	⋮	**Channel 16**
	W106	**W206**	**W306**	**W406**	**W10**	**W20**	⋮	**W160**
20 mA output current	IN	IN	IN	IN	IN	IN		IN
10 mA output current	OUT	OUT	OUT	OUT	OUT	OUT		OUT

5.3.2.4 Operation/Test Mode Switch

You can select either operation mode or test mode only on the boards DSAO 110 and DSAO 120 by installing jumpers as shown in Table 5-31 and Table 5-32 below. In test mode, you can adjust the zero point and gain for each channel with potentiometers. For DSAO 110, these potentiometers are located on the board. For DSAO 120, the potentiometers are accessible through the front panel.

Table 5-31. Selection of Operation/Test Mode on DSAO 110

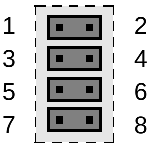
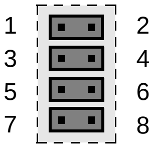
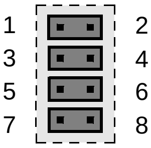
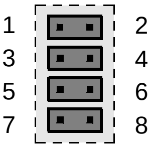
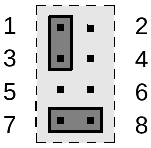
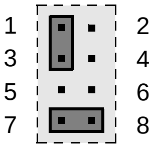
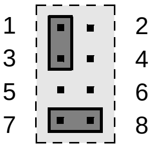
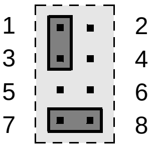
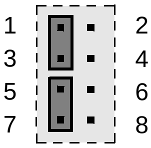
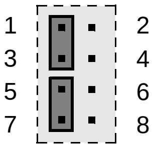
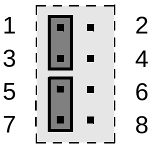
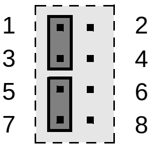
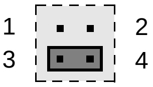
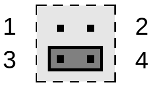
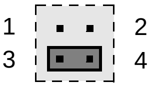
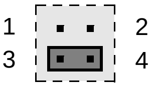
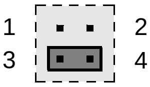
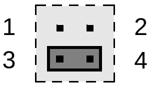
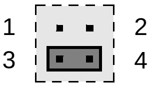
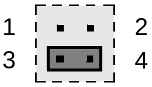
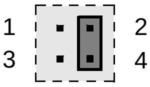
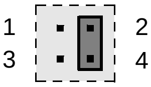
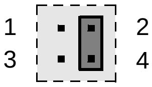
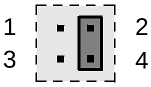
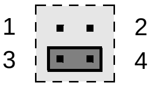
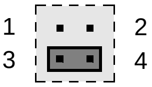
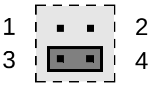
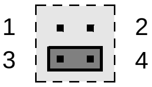
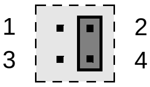
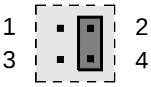
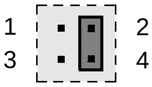
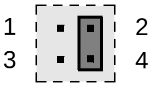
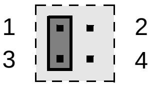
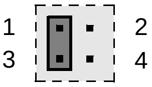
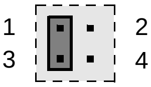
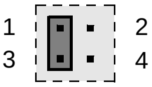
Function		**DSAO 110**			
		Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
Operation		S101 	S201 	S301 	S401 
Test	Zero calibra-tion	S101 	S201 	S301 	S401 
	Full scale	S101 	S201 	S301 	S401 

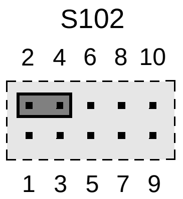
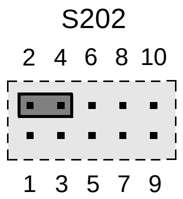
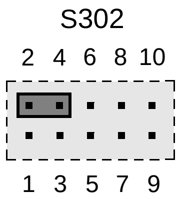
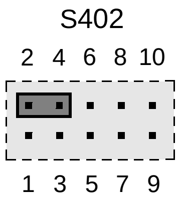
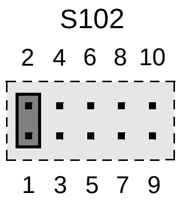
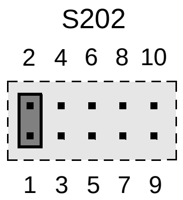
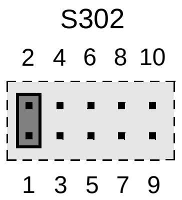
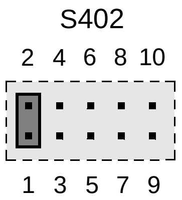
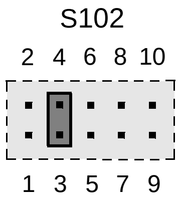
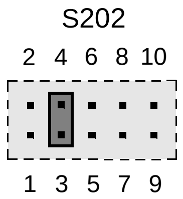
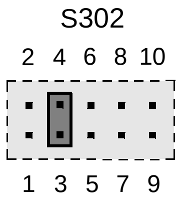
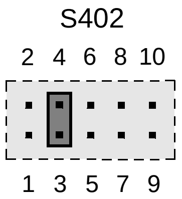
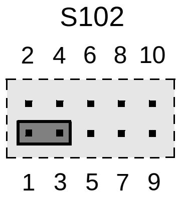
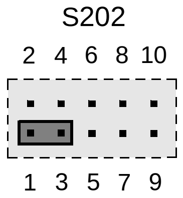
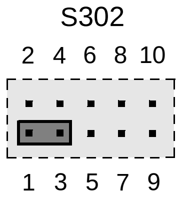
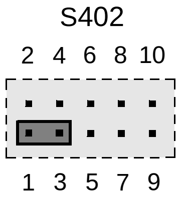
Table 5-32. Selection of Operation/Test Mode on DSAO 120

Function		**DSAO 120**				
		Channel 1	**Channel 2**	**...**	**Channel 7**	**Channel 8**
Operation		S2 	S2 	...	S2 	S2 
		S10 	S20 		S70 	S80 
Test	Zero calibration	S2 	S2 		S2 	S2 
		S10 	S20 		S70 	S80 
	Full scale	S2 	S2 		S2 	S2 
		S10 	S20 		S70 	S80 

5.3.2.5 Selection of Gain Factor

You can select the gain factor for each channel on DSAO 110 using the jumpers shown in the table below. When the gain jumper is jumpered to gain "0 - 1" or "0 - 2," you can adjust the gain via the potentiometers on the front of DSAO 110.

Table 5-33. Selection of Gain Factor on DSAO 110

Function	**DSAO 110**			
	Channel 1	**Channel 2**	**Channel 3**	**Channel 4**
Gain factor: 0 - 1 (adjusted with a potentiometer)				
Gain factor: 1				
Gain factor: 0 - 2 (adjusted with a potentiometer)				
Gain factor: 2				

5.3.3 Connection of AO Boards to the Process (DSTA xxx)

Key data for the connection units DSTA 137, DSTA 160, DSTA 170, DSTA 17, DSTA 180 and DSTA 181, which are intended for analog output signals, are shown in the table below. Length omitted from type designations:

Table 5-34. Key Data for the Analog Output Signal Connection Units

Data	**DSTA 137 1)**	**DSTA 138 1)**	**DSTA 160**	**DSTA 170**	**DSTA 171**	**DSTA 180**	**DSTA 181**
Number of channels	16	16	4	8	8	16	16
Type of cable to DSAO	DSTK 150 / DSTK 221	DSTK 221	DSTK 153/ DSTK 223	DSTK 153/ DSTK 223	DSTK 221	DSTK 150/DSTK 221	DSTK 221, DSTK 240 (Hart)
Number of connections (screw terminals)	32 (16x2)	32 (16x2)	12 (4 x 3)	24 (8 x 3)	32 (8 x 4)	32 (16 x 2)	32 (16 x 2)
Cable area (screw terminals)	0.5 - 2.5 mm^2	0.5 - 2.5 mm^2					

1) This is an Object Oriented Connection Unit.

Three examples of connections of analog output boards are shown below.

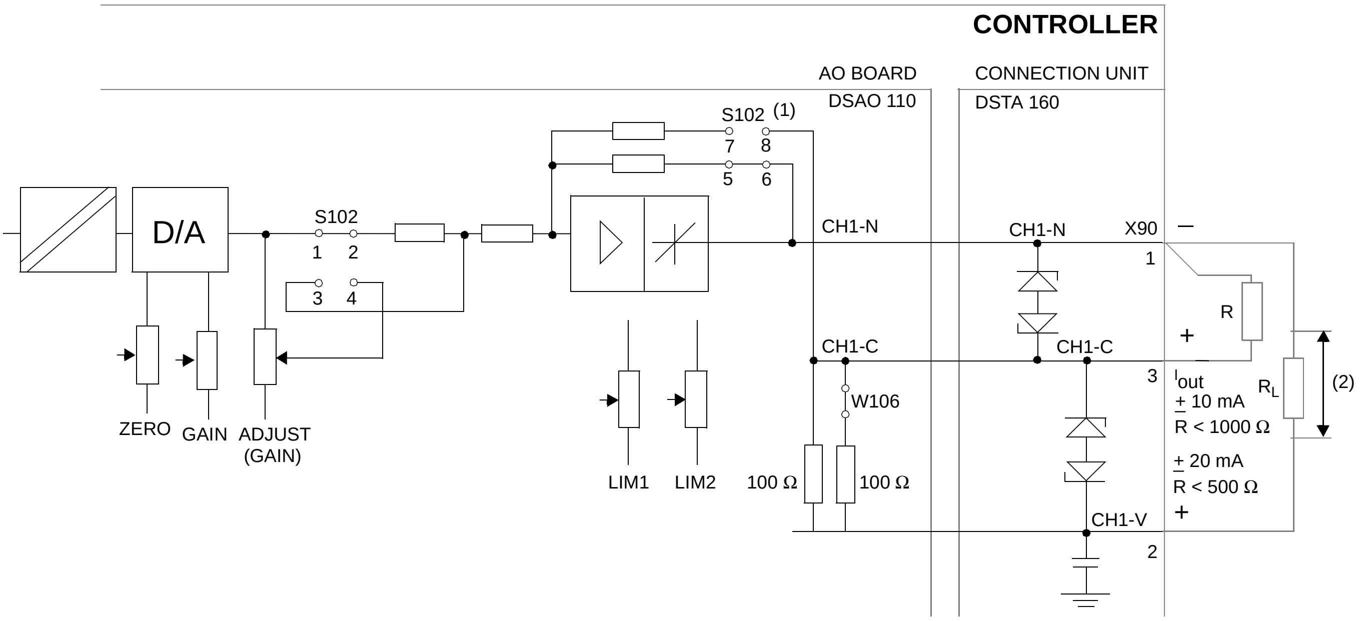


Figure 5-46. Example of Connection of DSAO 110

1) S102 (pins 5 ... 8) are to be jumpered for current or voltage signal in accordance with the instructions in Table 5-28 and Table 5-30.

2) V_{out} ±10 V; $R_L \geq 600\ \Omega$

NOTE

X90: 1 - 3 Connection of current signal.
X90: 1 - 2 Connection of voltage signal.

Connection unit DSTA 160, which is used for the board DSAO 110, is provided with screw terminals to enable you to connect four isolated output channels.

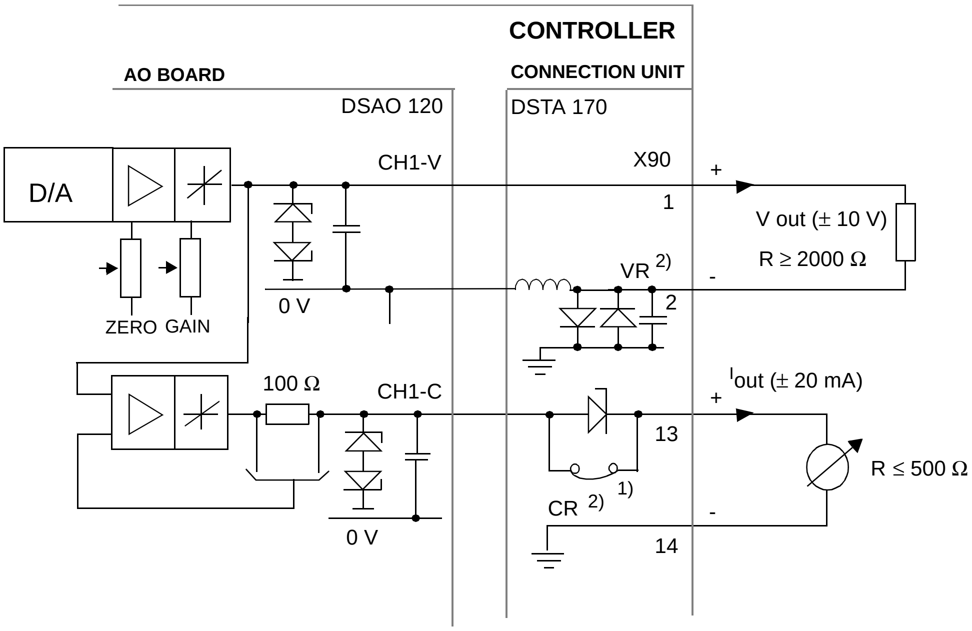


Figure 5-47. Example of Connection of DSAO 120

1) Jumper cut for parallel coupling of analog outputs.
2) VR = Voltage Return signal, CR = Current Return signal

NOTE

X90: 1 - 2 Connection of voltage signal.
X90: 13 - 14 Connection of current signal.

The connection unit DSTA 170, which is used for the board DSAO 120, is provided with 24 screw terminals to enable you to connect eight analog output signals. Use the other eight screw terminals for voltage distribution.

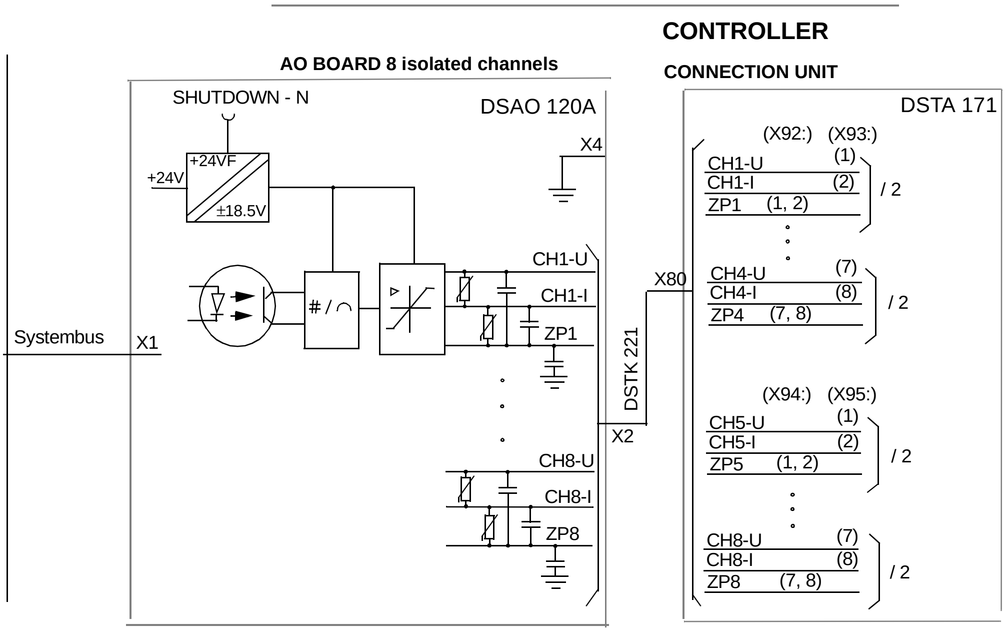


Figure 5-48. Example of Connection of DSAO 120A

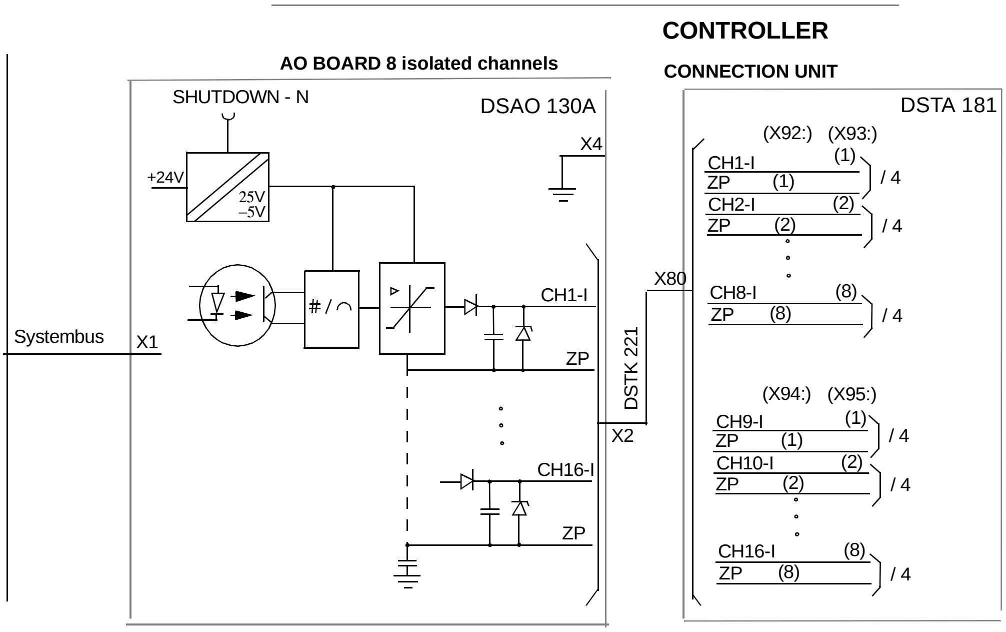


Figure 5-49. Example of Connection of DSAO 130A

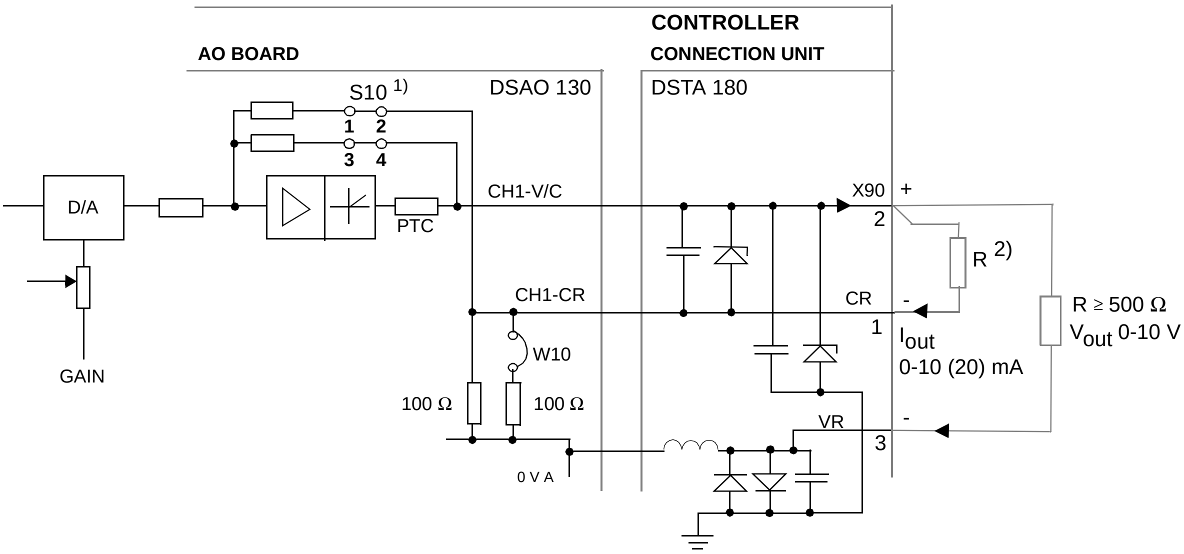


Figure 5-50. Example of Connection of DSAO 130

1) S10 is jumpered for current or voltage signal in accordance with the instructions in Table 5-29 and Table 5-30.
2) According to the formula below.

$$R \le \frac{(U - 5)}{Imax}$$

$$19\ V \le U \le 30\ V$$

NOTE

X90: 1 - 2 Connection of current signal.
X90: 2 - 3 Connection of voltage signal.

The connection unit DSTA 180/DSTA 181, which is used for the board DSAO 130, is provided with screw terminals to enable you to connect 16 analog output signals. Use the other screw terminal blocks for voltage distribution.

WARNING

The load connected to the current output must be potentially floating.

5.3.4 Jumpering of Connection Units for AO Boards

The only connection unit you can jumper is DSTA 170. The location of the solder jumpers on DSTA 170 is shown in Figure 5-52.

For information on the object oriented connection unit DSTA 137/DSTA 138 refer to Section 5.4 Object Oriented Connection Unit for Analog Signals.

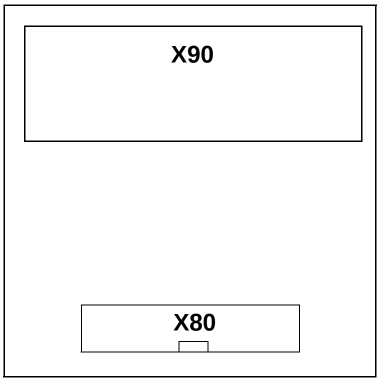


Figure 5-51. Connection Unit DSTA 160, Location of Connectors

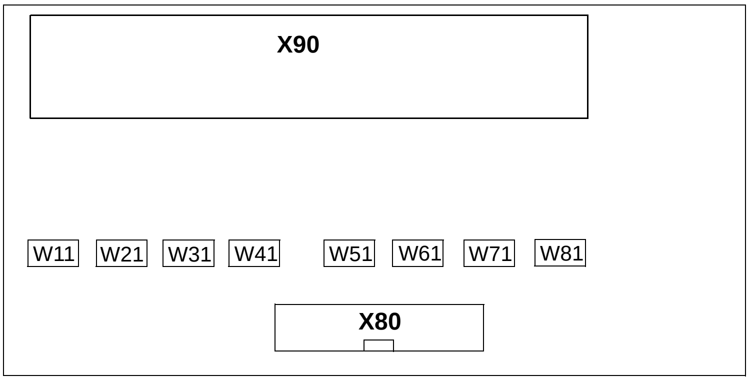


Figure 5-52. Connection Unit DSTA 170, Location of Solder Jumpers and Connectors

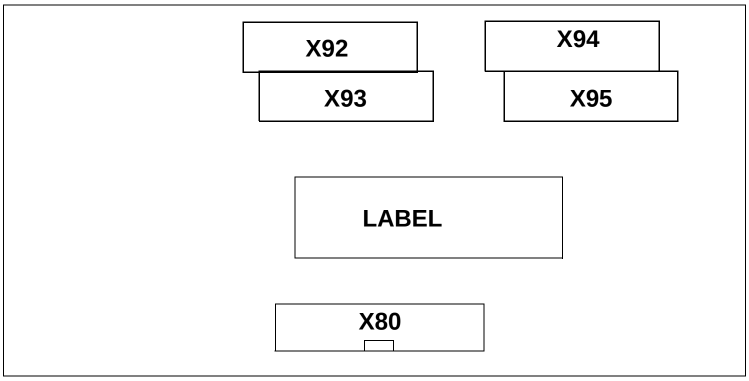


Figure 5-53. Connection Unit DSTA 171 and DSTA 181, Location of Connectors

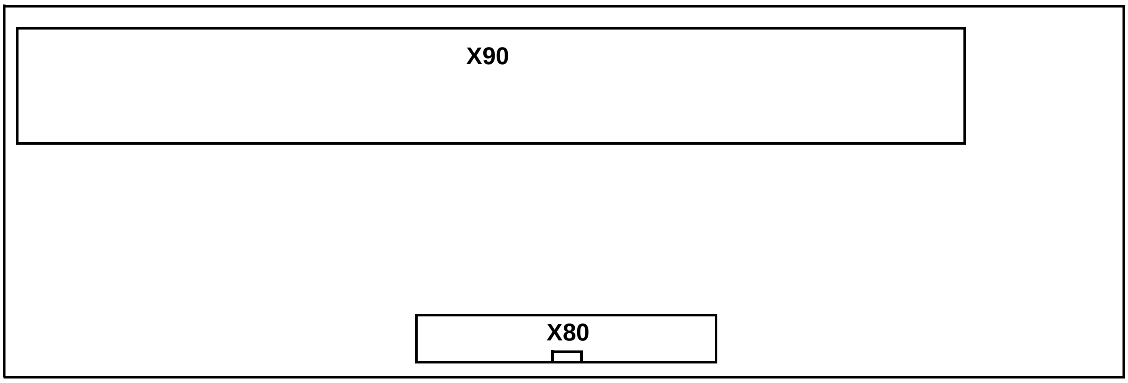


Figure 5-54. Connection Unit DSTA 180, Location of Connectors

Each channel on DSAO 120/DSAO 120A is both a voltage and a current output channel. The connection unit DSTA 170 has eight current output connections and eight voltage output connections, enabling you to choose the function of each channel by the connection.

Each current output is provided with a diode which you can bypass with a solder jumper. Cut this solder jumper when two current outputs from the same or from different boards are connected in parallel to the same control object. See Table 5-35 below.

Table 5-35. Selection of Normal or Parallel Operation of a Current Output

Function	**DSTA 170**			
	Channel 1	**Channel 2**	**...**	**Channel 8**
	W11	**W21**	**...**	**W81**
Normal operation	IN	IN	...	IN
Parallel operation	OUT	OUT	...	OUT

5.4 Object Oriented Connection Unit for Analog Signals

5.4.1 DSTA 137 Features

The Object Oriented Connection Unit DSTA 137 gives the following features:

- Plug- in connector for each object
- Object marking facilities
- PTC on 24 VDC for each channel provide short circuit proof
- Differential channels achieved by jumper (strap).

Refer to Table 5-15, Table 5-20, Table 5-26, and Table 5-34.

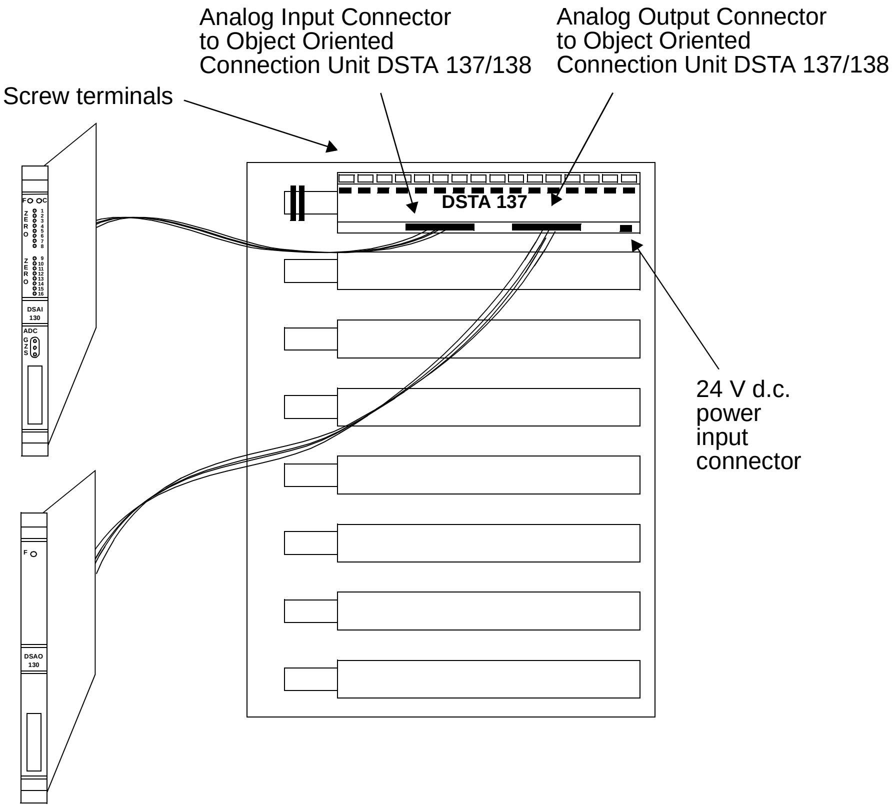


Figure 5-55. Object Oriented Connection Unit DSTA 137/DSTA 138

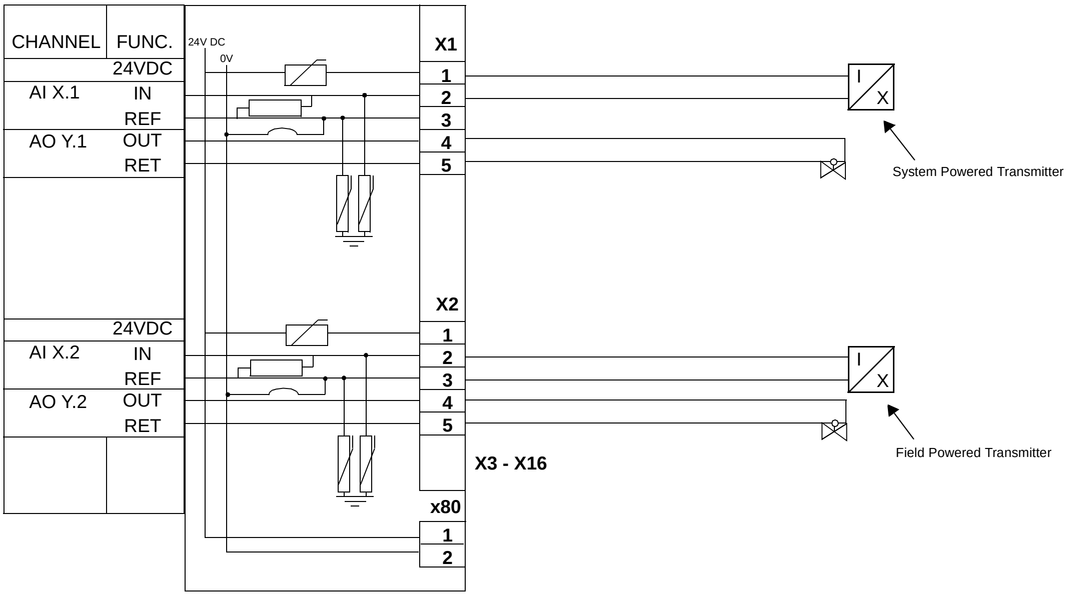


Figure 5-56. Analog Input/Output with DSTA 137

5.4.2 Jumpering of Object Oriented Connection Unit DSTA 137/DSTA 138

The object oriented connection unit DSTA 137 is jumpered according to Table 5-36.

Table 5-36. Jumpering of DSTA 137

Jumper/Switch Function	**Solder Jumpers for Connection Unit**
	DSTA 137
Selection of current or voltage signal	-
Directly grounded /floating supply voltage to transducer	W1-W3
Connection of return leads with grounded/non-grounded transducer	S1-S4
Production test	-

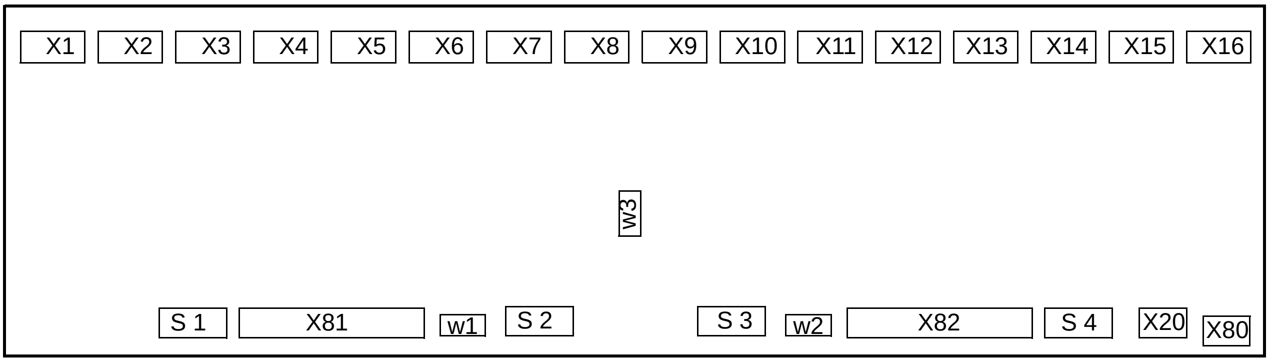


Figure 5-57. Connectors on DSTA 137

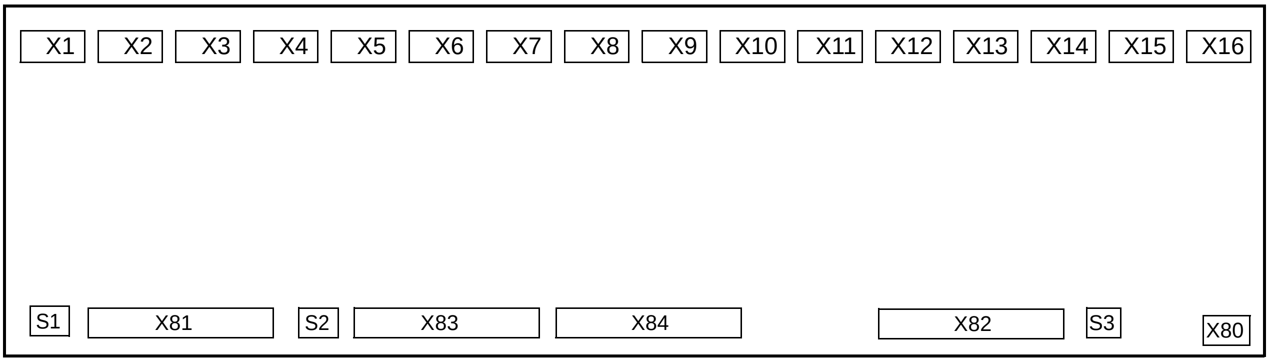


Figure 5-58. Connectors on DSTA 138

Jumpering of DSTA 138

The +24V return (0V_COM) can be connected to the Analog input (-) terminals via the strap jumpers S1 and S2. This shows an example for channel 1:

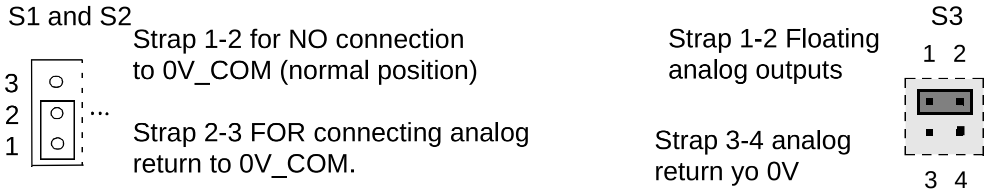

S1 and S2
3
2
1
Strap 1-2 for NO connection to 0V_COM (normal position)
Strap 2-3 FOR connecting analog return to 0V_COM.
Strap 1-2 Floating analog outputs
Strap 3-4 analog return yo 0V
S3
1 2
3 4

Figure 5-59. Strap Jumper S1 & S2 Options _ Channel 1 example

S1 is a group containing straps for channel 1 to 8, while S2 contains straps for channels 9 to 16. Within each strap group the pins for each channel increase by 3 for each channel (that is S1 pin 1, 2, 3 are for channel 1, S1 pins 4, 5, 6 are for channel 2, S2 pins 10,11, 12 are for channel 12, and so on). All analog outputs have a single return that is available at pin 5 of each termination. This returns id floating with respect to the 0V return of the +24V field power, but may be connected to it by moving S3 to the 3-4 position. But Note that all AO returns become common with any AI returns that have been strapped to the 0V position in this case.

5.5 Analog Input/Output Boards (DSAX 110/DSAX 110A)

The board DSAX 110/DSAX 110A have eight unipolar single-ended analog voltage/current inputs and eight unipolar analog current outputs. The input signals are converted and the output signals are controlled cyclically by a board processor and a board-specific program. The zero level and the gain are automatically corrected for the inputs with the help of the board processor DSAX 110. DSAX 110A is factory calibrated and aging stable. The outputs are monitored by means of read-back.

The process signals are connected to the board via the connection unit DSTA 001A/DSTA 001B and the cable DSTK 153/DSTK 223. Select current or voltage input with a solder jumper on the connection unit DSTA 001A, for DSTA 001B select current or voltage inputs with selectable jumpers.
To obtain voltage output, connect a shunt of 500 ohms (located on the connection unit) at the current output. Connect the shunt by jumpering in the process contact.

To activate DSAX 110/DSAX 110A, connect 24 V external supply voltage to connection unit DSTA 001/ DSTA 001A/ DSTA 001B (X90: 1, 2).

You can use the board in two different applications: singly as a conventional I/O board or in pairs in a 1:1 redundant coupling.

The possibility of redundant coupling makes the board suitable for use when a high degree of availability is required. The two boards are connected to the same connection unit in a redundant coupling.

DSAX 110/DSAX 110A also has two digital inputs and two digital outputs. These are connected internally via the connection unit and are only used for status signalling between the redundant boards.
DSAX 110A have galvanic isolation between channels and system. All in and out channels are isolated together in one group from the system.

In cases a voltage output is needed, shunt resistors on the DSTA 001B can be strapped to current outputs to give a 0 - 10V (20mA x 500 ohms) signal range. The resulting accuracy depends on the input resistance of the load device to current sharing between the shunt and the load. A high resistance > 100 Kohms input is recommended.

The figure below shows the block diagram for analog inputs and outputs with redundant couplings.

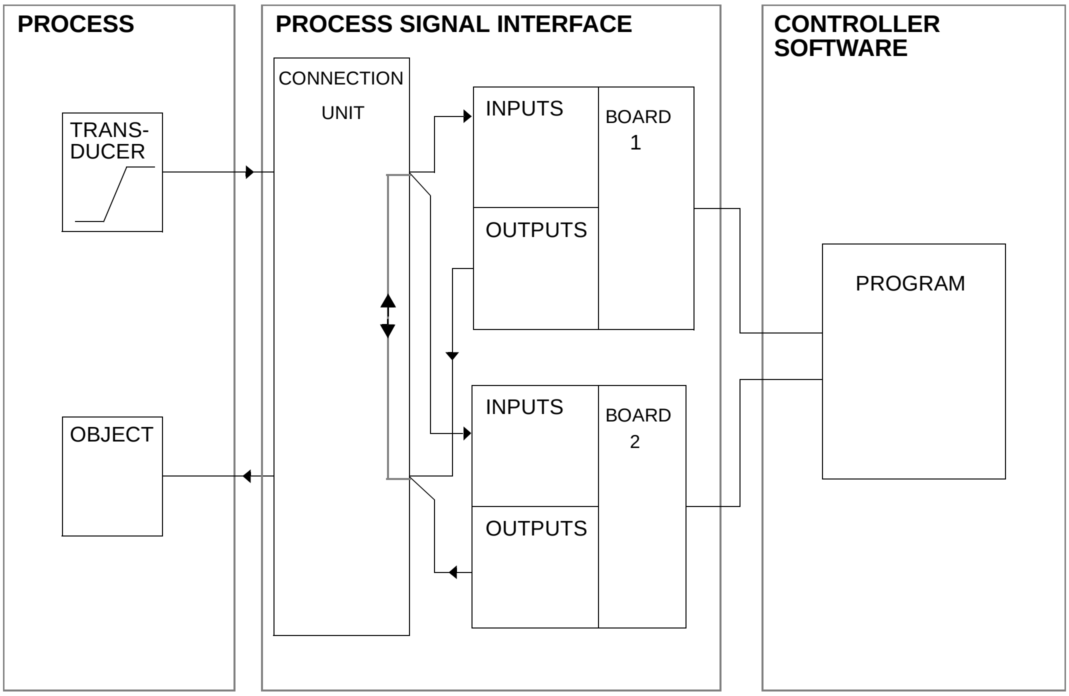


Figure 5-60. Analog Input/Output Signal with Redundant Coupling, Block Diagram

Table 5-37. DSAX 110/DSAX 110A and Connection Unit DSTA 001A/DSTA 001B, Key Data

Data	Analog inputs	Analog outputs
Number of channels	8	8
Type of input/output	Single-ended unipolar	Unipolar current output
Galvanically insulated	Channel to system. DSAX 110A only	Channel to system. DSAX 110A only
CMV[2)]	-	U - (8 + I_{max} x R_L) 19V ≤ U+ ≤ 32V
Signal range	0 - +10 V 0 - +5 V 0 - +20 mA[1)]	0 - +20 mA 0 - +10 V (over R_S = 500 Ω on DSTA 001A/ DSTA 001B)
Input impedance	10 MΩ (voltage input)	-
Resolution	12 bits	12 bits
Inaccuracy excl. shunt @ 25°C - Maximum - Typical	 0.05% ± 1 LSB 0.025% ± 1 LSB	 0.1% ± 1 LSB 0.05% ± 1 LSB

Table 5-37. DSAX 110/DSAX 110A and Connection Unit DSTA 001A/DSTA 001B, Key Data (Continued)

Data	Analog inputs	Analog outputs
Temperature drift - Maximum - Typical	 0.08%/10°C 0.03%/10°C	 0.1%/10°C 0.05%/10°C
Updating time	20 ms	8 ms
Redundant switching (output)	-	∆I = ± 50% of current value during a maximum of 3 ms
Voltage drop	-	8 V
Active filter	Limiting freq: 6.5 Hz, 2 poles Attenuation of 50 Hz: > 32 dB	Rise time, typical 50 µs Fall time, typical 50 µs
Temperature drift shunt - Maximum - Typical	$R_{sh} = 250\ \Omega \pm 0.05\%$ 25 ppm/°C 10 ppm/°C	-
Output load	-	$\mathrm{RLmax} = \frac{U - (8 + CMV)}{Imax}$ 19 V ≤ U ≤ 32 V @ $R_L$max
Current Consumption	+ 5V 500 mA	
	+24V internal 165 mA	
	+ 24V external 200 mA	
Interference immunity in acc. with: - EN 50082-2	 yes	 yes
Cable area (screw terminals on the connection unit)	0.5 - 2.5 mm^2	

1) With current signal, a shunt is jumpered on the connection unit.
2) CMV = Common Mode Voltage

5.5.1 Supervision Functions

Supervision of input/output signals and internal tests is performed by the board processor. See below:

- The analog outputs are supervised internally on the board by reading back, channel by channel
- The analog inputs are monitored and adjusted automatically with respect to the zero point and gain
- The board processor and memory are checked internally with check sum calculations and a watchdog.
- Program execution is monitored by watchdog.

5.5.2 Redundancy

Output current from the two boards are summed at the common connection unit. If the internal supervision on DSAX 110/DSAX 110A detects a value at an output which is not the value commanded, the faulty board is disconnected and the remaining board delivers 100 percent of the value. The switch-over in case of a board failure or replacement is controlled by the digital status signals.

For analog inputs with redundancy, the redundancy function is handled by the controller software.

5.5.3 Connection of DSAX 110 to the Process

Key data for the connection unit DSTA 001A is shown in the table below.

Table 5-38. Key Data for the Connection Unit DSTA 001A

Data	DSTA 001A
Number of channels	16
Cable to DSAX 110	DSTK 153/ DSTK 223
Number of connections (Screw terminals)	48
Cable area (screw terminals)	0.5 - 2.5 mm^2

5.5.4 Connection of DSAX 110A to the Process

Key data for the connection unit DSTA 001B is shown in the table below.

Table 5-39. Key Data for the Connection Unit DSTA 001B

Data	DSTA 001B
Number of channels	16
Cable to DSAX 110A	DSTK 223
Number of connections (Screw terminals)	48
Cable area (screw terminals)	0.5 - 2.5 mm^2

Examples of the connection of analog input/output signals are shown below.

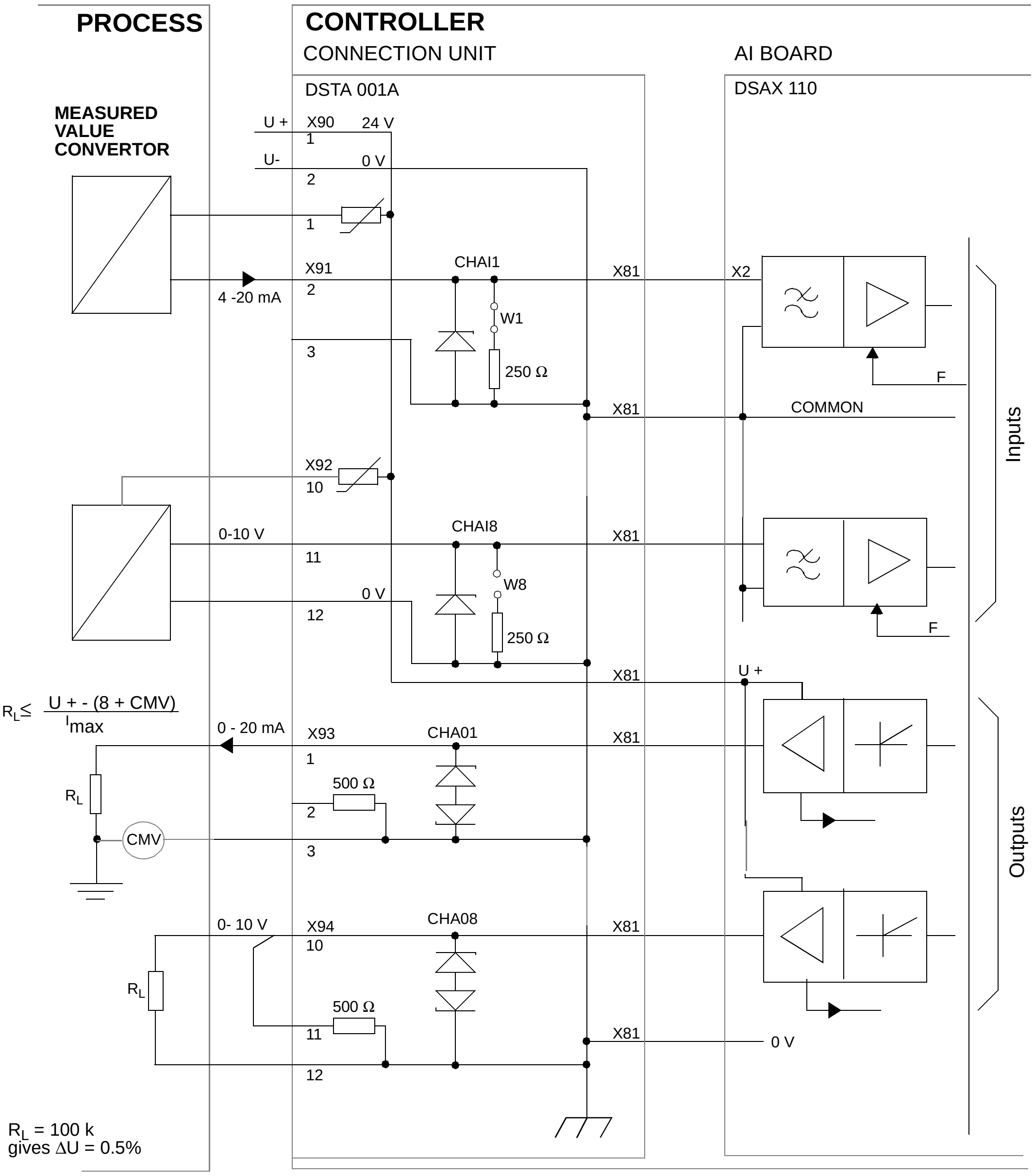


Figure 5-61. Example of Connection, DSAX 110 and DSAX 110A in Single Connection

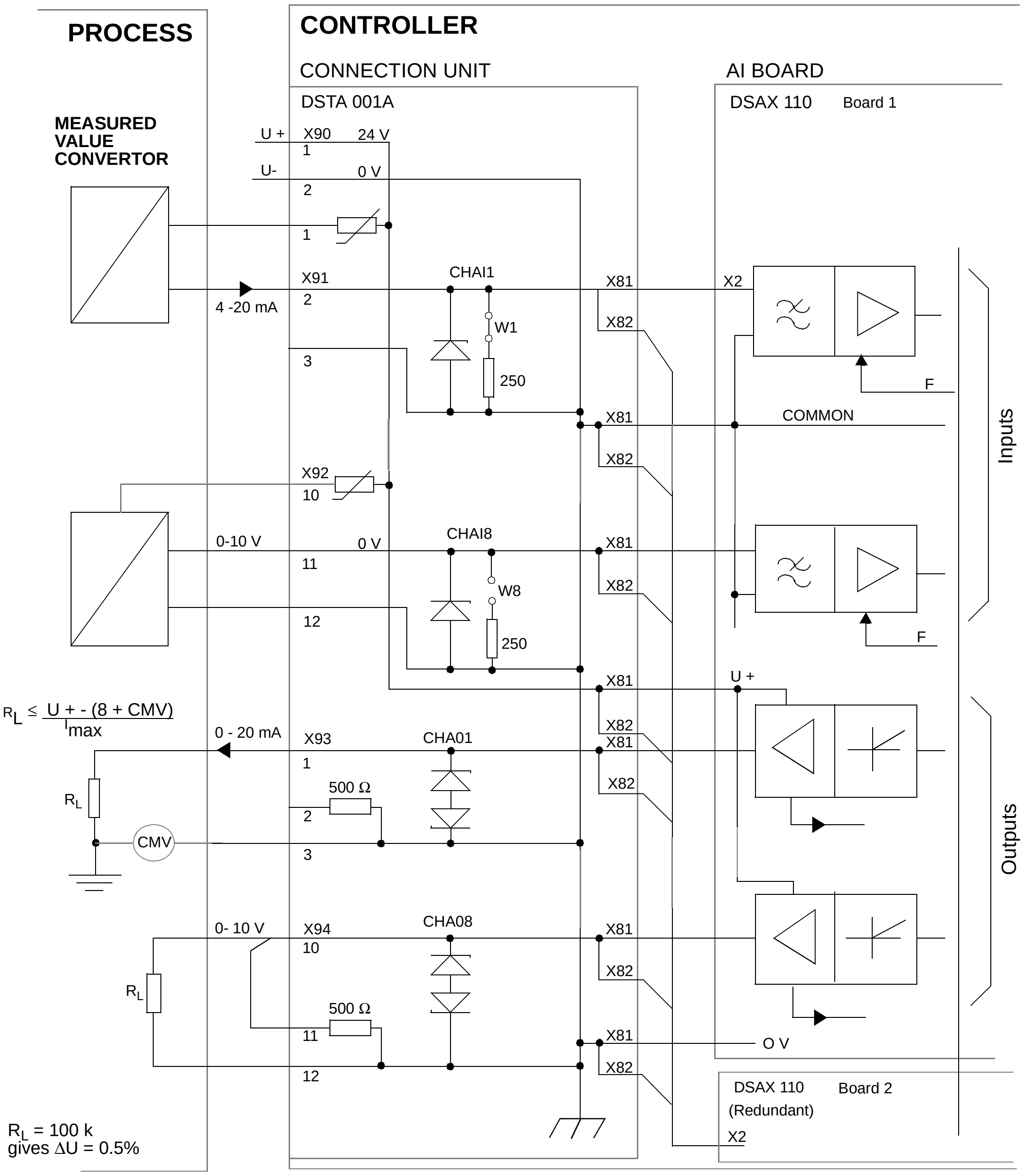


Figure 5-62. Example of Connection, DSAX 110/DSAX 110A in Redundant Connection

5.5.5 Front Panel

The figure below shows the front panel of DSAX 110/DSAX 110A. Examples of the LED indications for different operation modes are shown in Table 5-40.

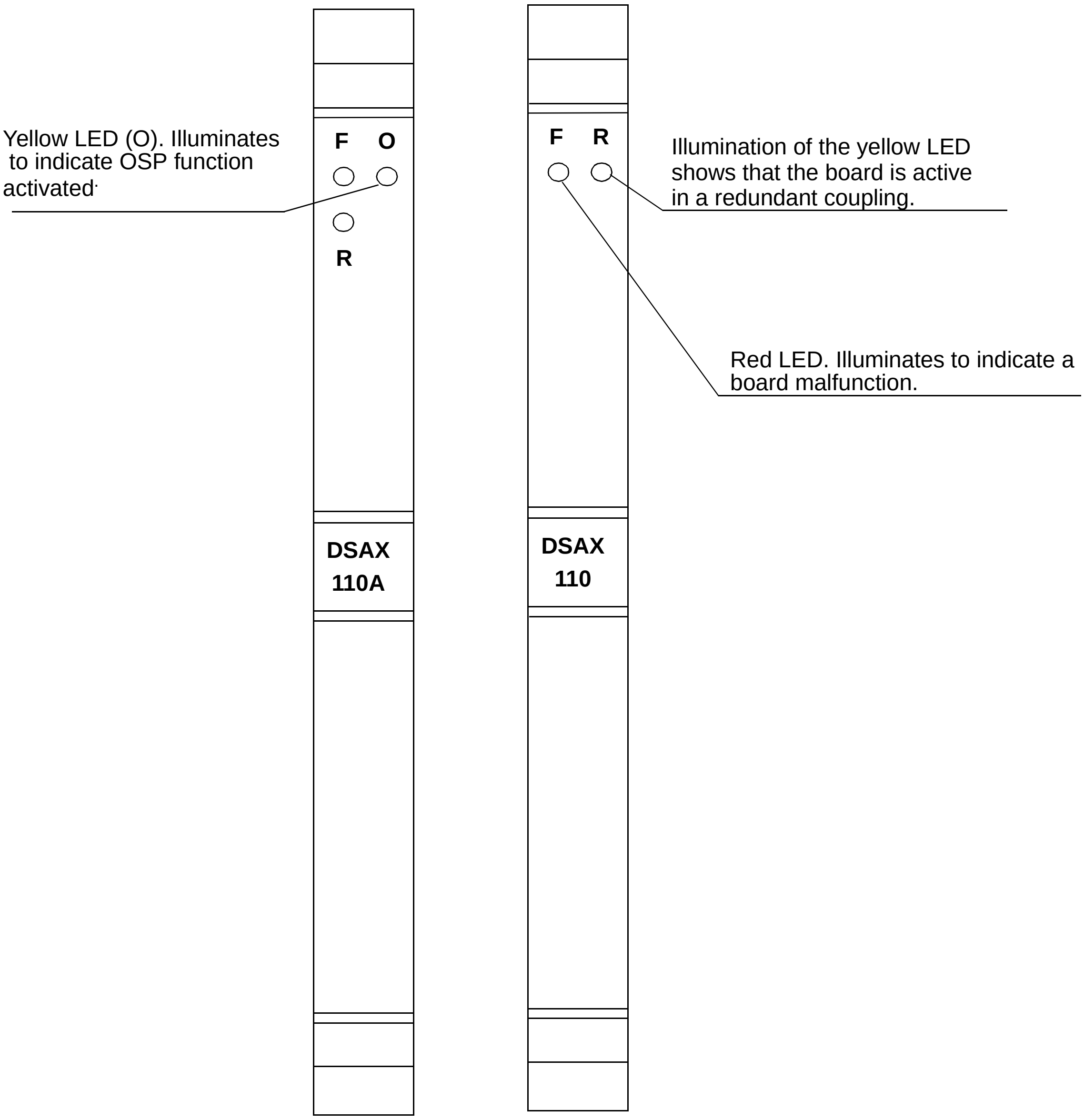

Yellow LED (O). Illuminates to indicate OSP function activated.
F
O
R
DSAX 110A
F
R
Illumination of the yellow LED shows that the board is active in a redundant coupling.
Red LED. Illuminates to indicate a board malfunction.
DSAX 110

Figure 5-63. Front Panel of DSAX 110A/DSAX 110

Table 5-40. LED Indication in Normal Operation and Malfunction (DSAX 110)

Function	Comment	Board A	Board B
Normal operation	A: Has not received parameters B: Has not received parameters	F R ● ○	F R ● ○
	Only board A is active. A: Run mode B: Has not received parameters	F R ○ ○	F R ● ○
	Boards A and B are active A: Run mode redundancy B: Run mode redundancy	F R ○ ●	F R ○ ●
	Board A is active A: Run mode B: The board is missing	F R ○ ○	
Malfunction	Only board A is active A: Run mode B: Disconnected	F R ○ ○	F R ● ○
	Only board B is active A: Disconnected B: Run mode	F R ● ○	F R ○ ○
	A: Disconnected B: Disconnected	F R ● ○	F R ● ○

● = illuminated LED
○ = not illuminated LED

The “R” LED illuminates only when the board is coupled for redundancy and both boards are in the run mode.

Table 5-41. Example of indication on two DSAX 110A boards connected to the same unit under normal conditions

Board A	Board B	F -light emitting LED	R -light emitting LED	O -light emitting LED	Value on output channels
Parameters not received	Parameters not received	A: switched ON B: switched ON	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: 0 B: 0
Operational mode	Parameters not received	A: switched OFF B: switched ON	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: operational mode 100% B: 0
Operational mode	Operational mode	A: switched OFF B: switched OFF	A: switched ON B: switched ON	A: switched OFF B: switched OFF	A: operational mode 50% B: operational mode 50%
Operational mode	Not mounted	A: switched OFF	A: switched OFF	A: switched OFF	A: operational mode 100%

Table 5-42. Example of indication on two DSAX 110A boards connected to the same unit under disturbed conditions

Board A	Board B	F -light emitting diode	R -light emitting diode	O -light emitting diode	Value on output channels
Operational mode	Board disconnected in the controller	A: switched OFF B: switched ON	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: operational mode 100% B: 0
Board disconnected	Board disconnected in the controller	A: switched ON B: switched ON	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: 0 B: 0
Operational mode	Board lost connection to system bus	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: switched OFF B: switched ON if OSP selected	A: operational mode B: 0
Board lost connection to system bus	Board lost connection to system bus	A: switched OFF B: switched OFF	A: switched OFF B: switched OFF	A: switched ON if OSP selected B: switched ON if OSP selected	A: 0 B: 0
Board lost connection to system bus	Board disconnected in the controller	A: switched OFF B: switched ON	A: switched OFF B: switched OFF	A: switched ON if OSP selected B: switched OFF	A: 0 B: 0

5.5.6 Jumpering of DSAX 110/DSAX 110A

DSAX 110 has two switch groups (see Table 5-43). Figure 5-64 below shows the location of the switch groups on DSAX 110. The switch functions are described below.

Table 5-43. Jumpering of DSAX 110

Switch Function	Switch Group
Address	S1
Production Test	S2

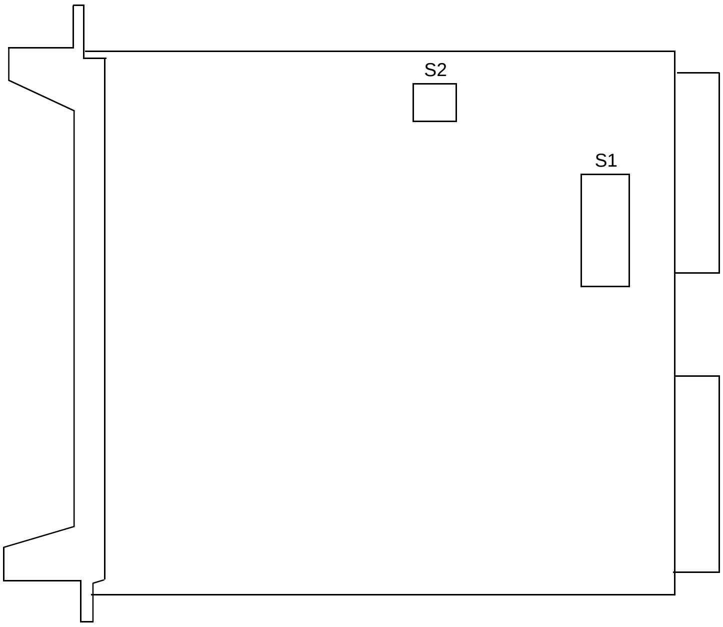


Figure 5-64. Analog Input/Output board DSAX 110, Location of Switch Groups

DSAX 110A has two switch groups (see Table 5-44) Figure 5-65 shows the location of the switch group on DSAX 110A. The jumper function are described below:

Table 5-44. Jumpering of DSAX 110A

Switch Function	Switch Group
Address Function	S1
Inhibit	X4

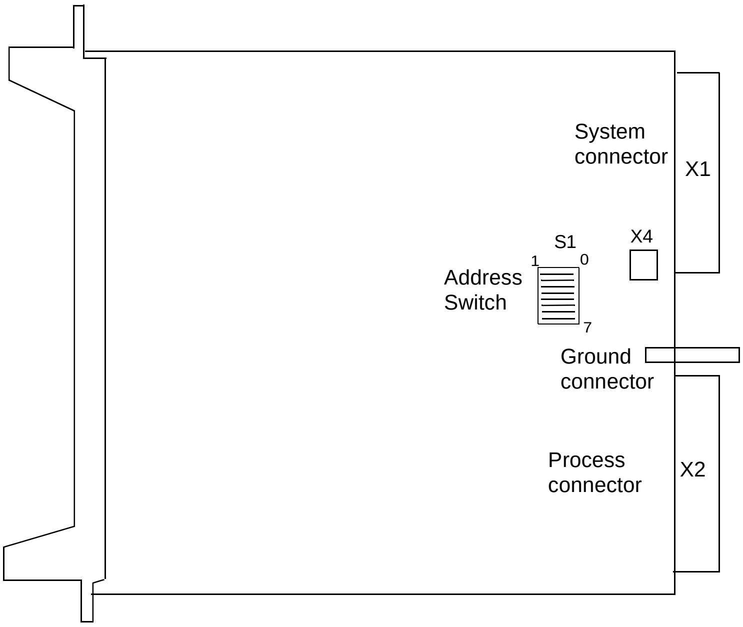


Figure 5-65. Analog Input/Output Boards DSAX 110A Location of Switch Groups

5.5.6.1 Address Switch

Jumper the address with the switch group S1. The address range is H'C0 - H'EF (hexadecimal notation), which corresponds with 192 - 239 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

5.5.6.2 Production Test Switch (DSAX 110 only)

Use switch group S2 for production tests. It is always jumpered as shown below.

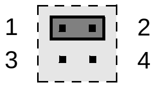


Figure 5-66. Jumpering of S2

5.5.6.3 Inhibit Switch (DSAX 110A only)

If the Inhibit goes active the normal program execution stops and the outputs deactivate. Taking the jumper X4 away prevents the board from react on an active Inhibit signal and the output will hold the values. The jumper shall normally be mounted in the Normal position.

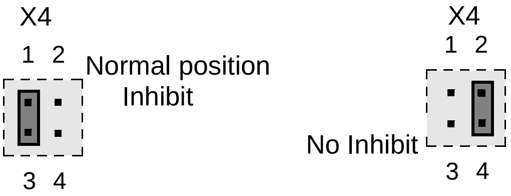


Figure 5-67. Inhibit switch

5.5.7 Jumpering of Connection Unit DSTA 001A

The location of solder jumpers and connectors on DSTA 001A is shown in the figure below.

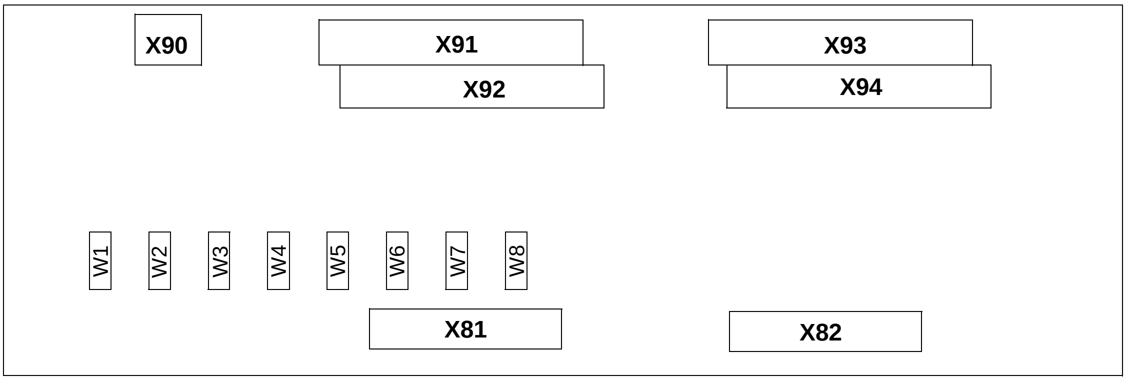


Figure 5-68. Connection unit DSTA 001A, Location of Solder Jumpers and Connectors

NOTE

X81: Ribbon cable contact board 1.
X82: Ribbon cable contact board 2.
X90: External supply of analog outputs.
X91, X92: Process connector, analog inputs.
X93, X94: Process connector, analog outputs.

Plug process and supply cables into terminal blocks in groups. Always connect the external power supply (+24 V) in X90.

You can select current or voltage input signals on the connection unit DSTA 001A for each channel using solder jumpers. To select voltage signal as input to a channel, cut the relevant solder jumper. The connection unit is delivered with all solder jumpers in place; that is, the default selection of every channel is current signal. The jumpering for different functions is shown in the table below.

Table 5-45. Selection of Current or Voltage Input Signals

Function		**DSTA 001A**			
		Channel 1	**Channel 2**	**...**	**Channel 8**
		W1	**W2**	**...**	**W8**
Inputs	Selection of current signal	IN	IN	...	IN
	Selection of voltage signal	OUT	OUT	...	OUT

5.5.8 Jumpering of Connection Unit DSTA 001B

The location of jumpers and connectors on DSTA 001B is shown in the figure below.

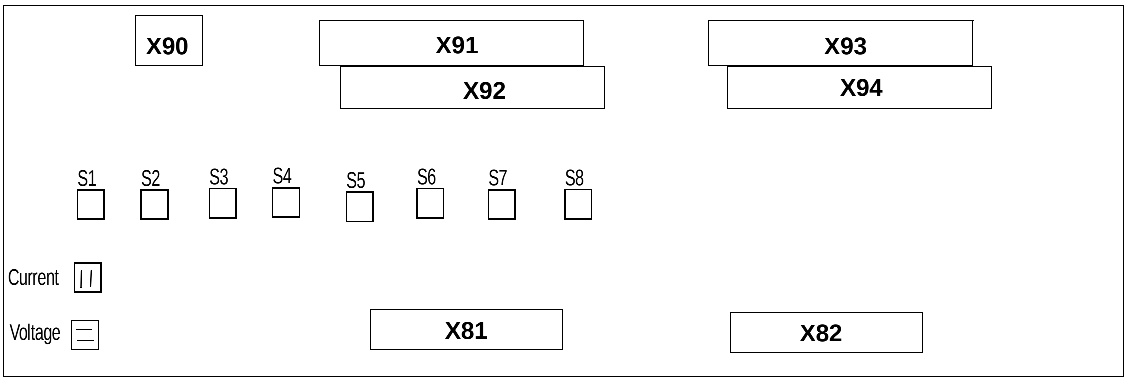


Figure 5-69. Connection unit DSTA 001B

NOTE

X81: Ribbon cable contact board 1.
X82: Ribbon cable contact board 2.
X90: External supply of analog outputs.
X91, X92: Process connector, analog inputs.
X93, X94: Process connector, analog outputs.

Plug process and supply cables into terminal blocks in groups. Always connect the external power supply (+24 V) in X90.

You can select current or voltage input signals on the connection unit DSTA 001B for each channel using jumpers. For jumper setting see current/voltage marking on the board.

5.6 Digital Input Boards (DSDI xxx)

All digital input boards have 32 channels and the inputs are opto-isolated from the system potential.

The figure below shows the block diagram for an digital input signal.

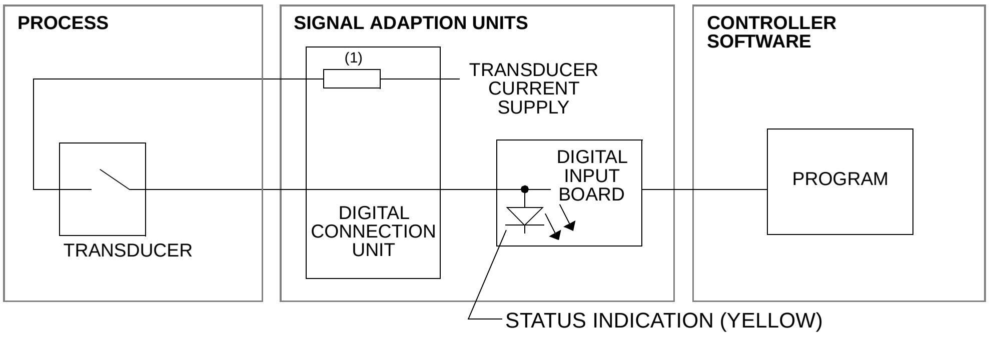


Figure 5-70. Digital Input Signal, Block Diagram

The input signals are filtered on the input board to suppress the effects of electrical interference and bouncing contacts. For boards which do not have optional filter time (DSDI 115 and DSDI 125), the filter time is 5 ms symmetrically.

Boards with optional filter time (DSDI 110A/DSDI 110AV1 and DSDI 120A/DSDI 120AV1) can work with a symmetric filter (with d.c. signals) or asymmetric filter (with a.c. signals) with respect to delayed switch-on and switch-off. DSDI 110A/DSDI 110AV1 and DSDI 120A/ DSDI 120AV1 also support time stamping of the input signals.

The reading of digital input signals can be cyclic or interrupt-controlled. The boards DSDI 115 and DSDI 125 do not have interrupt-activating event-handling.

The circuit boards DSDI 110A/AV1 and DSDI 115 are intended for 24 V d.c. signals whereas DSDI 120A/DSDI 120AV1 and DSDI 125 are intended for 48 V d.c. signals. You can also use DSDI 110A/DSDI 110AV1 and DSDI 115 for 24 V a.c./d.c, 120 V a.c./d.c. and 230 V a.c. in combination with the connection units DSTD 145, DSTD 147, DSTD 148, or DSTD 195, DSTD 196, DSTD 197 and DSTD 198. The input circuits on the board are insulated individually or in groups.

You can combine circuit boards, connection units and cables as shown in Table 5-47 to Table 5-51.

Table 5-46. Digital Input Board, Key Data

Data	**DSDI 110A/ DSDI 110AV1**	**DSDI 110A/ DSDI 110AV1**
	DSTD 150A	**DSTD 190/ DSTD 190V1**
	DSTK 150/ DSTK 221	**DSTK 150/ DSTK 221**
Number of channels	32 (2 x 16)	32 (4 x 8)
Rated voltage	24 V d.c.	24 V d.c.
Input voltage range, “1”	15 - 35 V	15 - 35 V
Input voltage range, “0”	-25 - +5 V	-25 - +5 V
Impedance	4 kΩ	4 kΩ
Filter times: - Symmetrical - Asymmetrical (switch on) - “Pulse capture” (on/off)	 0 - 127 ms 0 - 63 ms 100/2000 ms	 0 - 127 ms 0 - 63 ms 100/2000 ms
Event detection	yes	yes
Current consumption +5V	Typ. 460 mA	Typ. 460 mA
Current consumption 24 V	-	-
Power dissipation1)	5.5 W	5.5 W
Insulation test voltage, 50 Hz for 1 minute	500 V	500 V
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV2)	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

Table 5-47. Digital Input Board, Key Data (Table 1 of 2)

Data	**DSDI 110A/DSDI 110AV1 + 4 x DSTD 19x**			
	DSTD 195	**DSTD 196/ DSTD 196P**	**DSTD 197**	**DSTD 198**
	DSTK 165/DSTK 226			
Number of channels	4 x 8	4 x 8	4 x 8	4 x 8
Rated voltage	24 V a.c./d.c.	24 V d.c.	110 V d.c. 120 V a.c./d.c.	230 V a.c.
Input voltage range, “1”	15 - 35 V	15 - 35 V	75 - 145 Vrms	165 - 265 Vrms
Input voltage range, “0”	0 - +5 V	-25 - +5 V	0 - 20 Vrms	0 - 40 Vrms
Impedance	d.c.: 2.1 kΩ a.c.: 2.1 kΩ	4 kΩ	d.c.: 29 kΩ a.c.: 21 kΩ	31 kΩ (50 Hz) 26 kΩ (60 Hz)
Filter times:				
- Symmetrical	8 + (0 - 127) ms	0 - 127 ms	8 + (0 - 127) ms	8 + (0 - 127) ms
- Asymmetrical (switch on)	8 + (0 - 63) ms	0 - 63 ms	8 + (0 - 63) ms	8 + (0 - 63) ms
- “Pulse capture” (on/off)	8 + (100/2000) ms	100/2000 ms	8 + (100/2000) ms	8 + (100/2000) ms
Event detection	yes	yes	yes	yes
Current consumption +5V	Typ. 460 mA	Typ. 460 mA	Typ. 460 mA	Typ. 460 mA
Current consumption 24 V	Typ. 8mA/channel	-	Typ. 8mA/channel	Typ. 8mA/channel
Power dissipation1)	12 W2)	7.5 W2)	17 W2)	18.5 W2)
Insulation test voltage, 50 Hz for 1 minute	2 kV	500 V	2 kV	2 kV
Interference immunity in accordance with:				
- EN 50082-2	yes	yes	yes	yes
- IEC 255-4 impulse	5 kV	5 kV	5 kV	5 kV
- IEC 255-4 1 MHz CMV/NMV3)	2.5 kV / 2.5 kV	2.5 kV / 2.5 kV	2.5 kV / 2.5 kV	2.5 kV / 2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.
2) 6.5 W for 4 x DSTD 195, or 2.0 W for 4 x DSTD 196, 11.5 W for 4 x DSTD 197 and 13 W for 4 x DSTD 198 with 70 percent of the channels activated.
3) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

Table 5-48. Digital Input Board, Key Data (Table 2 of 2)

Data	**DSDI 110A/DSDI 110AV1 + DSTD 14x**[3]		
	DSTD 145	**DSTD 147**	**DSTD 148**
	DSTK 165/DSTK 226		
Number of channels [5]	32 (8 x 4)	32 (8 x 4)	32 (8 x 4)
Rated voltage	24 V a.c./d.c.	110 V d.c. 120 V a.c./d.c.	230 V a.c.
Input voltage range, “1”	15 - 35 V	75 - 145 Vrms	165 - 265 Vrms
Input voltage range, “0”	0 - +5 V	0 - 20 Vrms	0 - 40 Vrms
Impedance	d.c.: 2.1 kΩ a.c.: 2.1 kΩ	d.c.: 29 kΩ a.c.: 21 kΩ	31 kΩ (50 Hz) 26 kΩ (60 Hz)
Filter times: - Symmetrical - Asymmetrical (switch on) - “Pulse capture” (on/off)	 8 + (0 - 127) ms 8 + (0 - 63) ms 8 + (100/2000) ms	 8 + (0 - 127) ms 8 + (0 - 63) ms 8 + (100/2000) ms	 8 + (0 - 127) ms 8 + (0 - 63) ms 8 + (100/2000) ms
Event detection	yes	yes	yes
Current consumption +5V	Typ. 460 mA	Typ. 460 mA	Typ. 460 mA
Current consumption 24 V	Typ. 11mA/channel	Typ. 11mA/channel	Typ. 11mA/channel
Power dissipation[1]	14 W[2]	19 W[2]	20.5 W[2]
Insulation test voltage, 50 Hz for 1 minute	2 kV	2 kV	2 kV
Interference immunity in accordance with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV[4]	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.
2) 6.5 W for DSTD 145, 11.5 W for DSTD 147 and
13 W for DSTD 148 with 70 percent of the channels activated.
3) Object Oriented Connecting Unit
4) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
5) 8 objects with 4 digital inputs on each object

Table 5-49. Digital Input Board, Key Data

Data	**DSDI 115**	**DSDI 115**
	DSTD 150A	**DSTD 190/ DSTD 190V1**
	DSTK 150/ DSTK 221	**DSTK 150/ DSTK 221**
Number of channels	32 (2 x 16)	32 (4 x 8)
Rated voltage	24 V d.c.	24 V d.c.
Input voltage range, “1”	15 - 35 V	15 - 35 V
Input voltage range, “0”	-25 - +5 V	-25 - +5 V
Impedance	4 kΩ	4 kΩ
Filter times: - Symmetrical - Asymmetrical (switch on) - “Pulse capture” (on/off)	 5 ms - -	 5 ms - -
Event detection	no	no
Current consumption +5V	Typ. 160 mA	Typ. 160 mA
Current consumption 24 V	-	-
Power dissipation1)	4 W	4 W
Insulation test voltage, 50 Hz for 1 minute	500 V	500 V
Interference immunity in accordance with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV2)	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

Table 5-50. Digital Input Board, Key Data

Data	DSDI 115 + 4 x DSTD 19x			
	DSTD 195	DSTD 196/ DSTD 196P	DSTD 197	DSTD 198
	DSTK 165/DSTK 226			
Number of channels	4 x 8	4 x 8	4 x 8	4 x 8
Rated voltage	24 V a.c./d.c.	24 V d.c.	110 V d.c. 120 V a.c./d.c.	230 V a.c.
Input voltage range, “1”	15 - 35 V	15 - 35 V	75 - 145 Vrms	165 - 265 Vrms
Input voltage range, “0”	0 - +5 V	-25 - +5 V	0 - 20 Vrms	0 - 40 Vrms
Impedance	d.c.: 2.1 kΩ a.c.: 2.1 kΩ	4 kΩ	d.c.: 29 kΩ a.c.: 21 kΩ	31 kΩ (50 Hz) 26 kΩ (60 Hz)
Filter times: - Symmetrical - Asymmetrical (switch on) - “Pulse capture” (on/off)	8 + 5 ms - -	5 ms - -	8 + 5 ms - -	8 + 5 ms - -
Event detection	no	no	no	no
Current consumption +5V	Typ. 160 mA	Typ. 160 mA	Typ. 160 mA	Typ. 160 mA
Current consumption 24 V	Typ. 8mA/channel	-	Typ. 8 mA/channel	Typ. 8mA/channel
Power dissipation[1]	10.5 W[2]	6 W[2]	15.5 W[2]	17 W[2]
Insulation test voltage, 50 Hz for 1 minute	2 kV	500 V	2 kV	2 kV
Interference immunity in accordance with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV[3]	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.

2) 6.5 W for 4 x DSTD 195, or 2.0 W for 4 x DSTD 196, 11.5 W for 4 x DSTD 197 and 13 W for 4 x DSTD 198 with 70 percent of the channels activated.

3) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

Table 5-51. Digital Input Board, Key Data

Data	**DSDI 120A/ DSDI 120AV1**	**DSDI 125**	**DSDI 120A/ DSDI 120AV1**	**DSDI 125**
	DSTD 150A		**DSTD 190/DSTD 190V1**	
	DSTK 150/DSTK 221		**DSTK 150/DSTK 221**	
Number of channels	32 (2 x 16)	32 (2 x 16)	32 (4 x 8)	32 (4 x 8)
Rated voltage	48 V d.c.	48 V d.c.	48 V d.c.	48 V d.c.
Input voltage range, “1”	33 - 60 V	33 - 60 V	33 - 60 V	33 - 60 V
Input voltage range, “0”	-50 - +10 V	-50 - +10 V	-50 - +10 V	-50 - +10 V
Impedance	8 kΩ	8 kΩ	8 kΩ	8 kΩ
Filter times: - Symmetrical - Asymmetrical (switch on) - “Pulse capture” (on/off)	 0 - 127 ms 0 - 63 ms 100/2000 ms	 5 ms - -	 0 - 127 ms 0 - 63 ms 100/2000 ms	 5 ms - -
Event detection	yes	no	yes	no
Current consumption +5V	Typ. 460 mA	Typ. 160 mA	Typ. 460 mA	Typ. 160 mA
Current consumption +24 V	-	-	-	-
Power dissipation1)	8.8 W	7.3 W	8.8 W	7.3 W
Insulation test voltage, 50 Hz for 1 minute	500 V	500 V	500 V	500 V
Interference immunity in accordance with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz (CMV/NMV2))	 yes 3 kV 2.5 kV/2.5 kV	 yes 3 kV 2.5 kV/2.5 kV	 yes 3 kV 2.5 kV/2.5 kV	 yes 3 kV 2.5 kV/2.5 kV

1) Power dissipation is calculated with 70 percent of the channels activated.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

5.6.1 Front Panels

Figure 5-71 shows the front panel of the boards DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/DSDI 120AV1 and DSDI 125. The input signal status is indicated with yellow LEDs (one per channel). Board fault is indicated with a red LED “F”. The LED “F” can also be activated by the controller software.

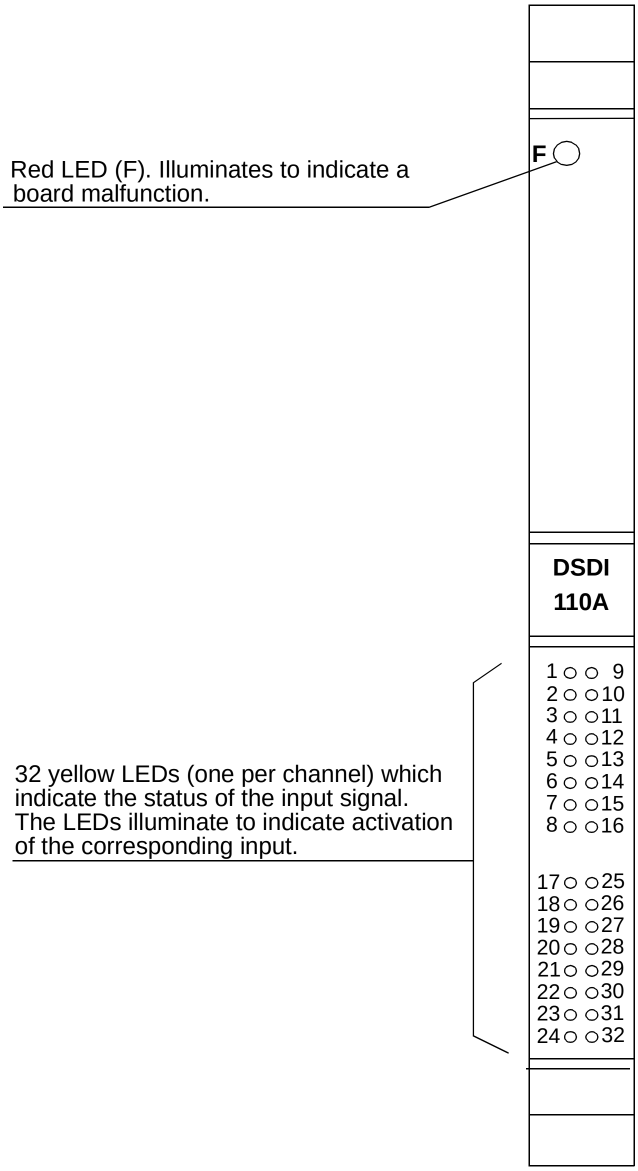

Red LED (F). Illuminates to indicate a board malfunction.
F
DSDI
110A
1 9
2 10
3 11
4 12
5 13
6 14
7 15
8 16
17 25
18 26
19 27
20 28
21 29
22 30
23 31
24 32
32 yellow LEDs (one per channel) which indicate the status of the input signal. The LEDs illuminate to indicate activation of the corresponding input.

Figure 5-71. Front Panel of DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/DSDI 120AV1 and DSDI 125

5.6.2 Jumpering of DI Boards

Digital input boards have a single switch group, S1, for address setting. DSDI 110A and DSDI 120A also have a switch group for production test purposes, S2.

Table 5-52. Jumpering of DI Boards

Switch Function	**Switch Groups for Board Type**			
	DSDI 110A/ DSDI 110AV1	**DSDI 115**	**DSDI 120A/ DSDI 120AV1**	**DSDI 125**
Address	S1			
Production test	S2/-	-	S2/-	-

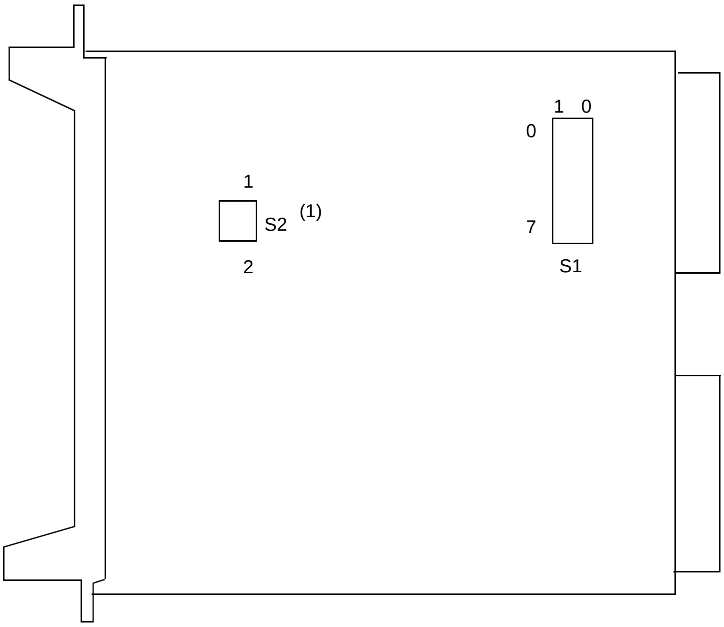


Figure 5-72. Digital Input Boards DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/ DSDI 120AV1 and DSDI 125, Location of Switch Groups

1) S2 only on DSDI 110A and DSDI 120A.

5.6.2.1 Address Switch

The address range for digital input boards is: H’60 - H’8F (H’ = hexadecimal notation), which corresponds to the range 96 - 143 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

5.6.2.2 Production Test Switch

The switch group S2 on the connection unit DSDI 110A and DSDI 120A is used for production tests only. It shall always be set according to Figure 5-73 below.

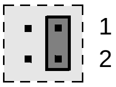


Figure 5-73. Production Test Switch on DSDI 110A and DSDI 120A

5.6.3 Connection of DI Boards to the Process (DSTD xxx)

Key data for the DI board connection units DSTD 145, DSTD 147, DSTD 148, DSTD 150A, DSTD 190/DSTD 190V1, DSTD 195, DSTD 196/DSTD 196P, DSTD 197 and DSTD 198 are presented in the following table. Some examples of connections for digital input signals also follow.

For more information about object oriented connection units refer to Section 5.8 Object Oriented Connection Units for Digital Signals.

Table 5-53. Key Data of the Connection Units

Data	**DSTD 145**3)	**DSTD 147**3)	**DSTD 148**3)	**DSTD 150A**	**DSTD 190/ DSTD 190V1**1)	**DSTD 195**1)	**DSTD 196/ DSTD 196P**1)	**DSTD 197**1)	**DSTD 198**1)
Number of channels	32	32	32	32	32	8	8	8	8
Fuses (glass tube 20 x 5.0 mm)	-	-	-	F1, F3 1.0 A (fast)	-2)	-	F1 1.0 A (fast)	-	-
Input voltage, max	35 V	145 V	265 V	60 V	60 V	35 V	35 V	145 V	265 V
Supply voltage, d.c.	24 V	24 V	24 V	-	-	24 V	24 V	24 V	24 V
Cable to DSDI	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 150/ DSTK 221	DSTK 150/ DSTK 221	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226
Process connection (screw terminals)	40	40	40	32	32	16	8 **4)**	16	16
Voltage distribution connection (screw terminals)	16	16	16	14	8	-	8	-	-
Width	470 mm	470 mm	470 mm	240 mm	120 mm	120 mm	120 mm	120 mm	120 mm
Cable area (screw terminals)	0.5 - 2.5 mm^2								

1) Width x length: 80 x 120 mm.
2) F1 - F4 2 A (fast) are not used for the DI application
3) Object Oriented Connection Unit.
4) DSTD 196P have pluggable screw terminals

The connection unit DSTD 150A for DSDI 110A, DSDI 110AV1, DSDI 115, 120A, DSDI 120AV1 and DSDI 125 (see Figure 5-74) is provided with disconnect able screw terminals which enable you to connect 32 digital signals. The channels are divided into two groups of 16 channels. Each group is fused and provided with terminal blocks for voltage distribution. The auxiliary voltage in each group is fused.

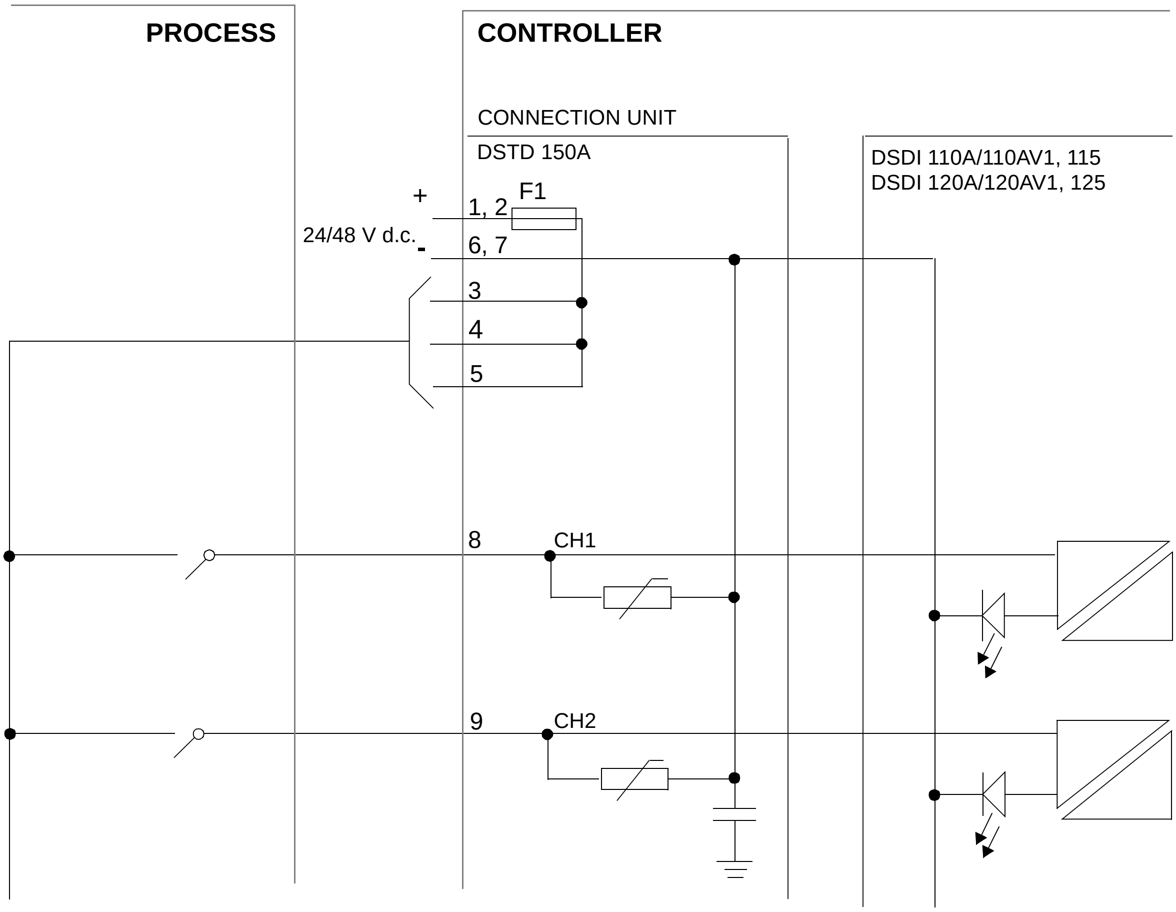


Figure 5-74. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/DSDI 120AV1 and DSDI 125

The connection unit DSTD 190 for DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/ DSDI 120AV1 and DSDI 125 (see Figure 5-74) is provided with screw terminals which enable you to connect 32 digital input signals.
The channels are divided into four groups of 8 channels.

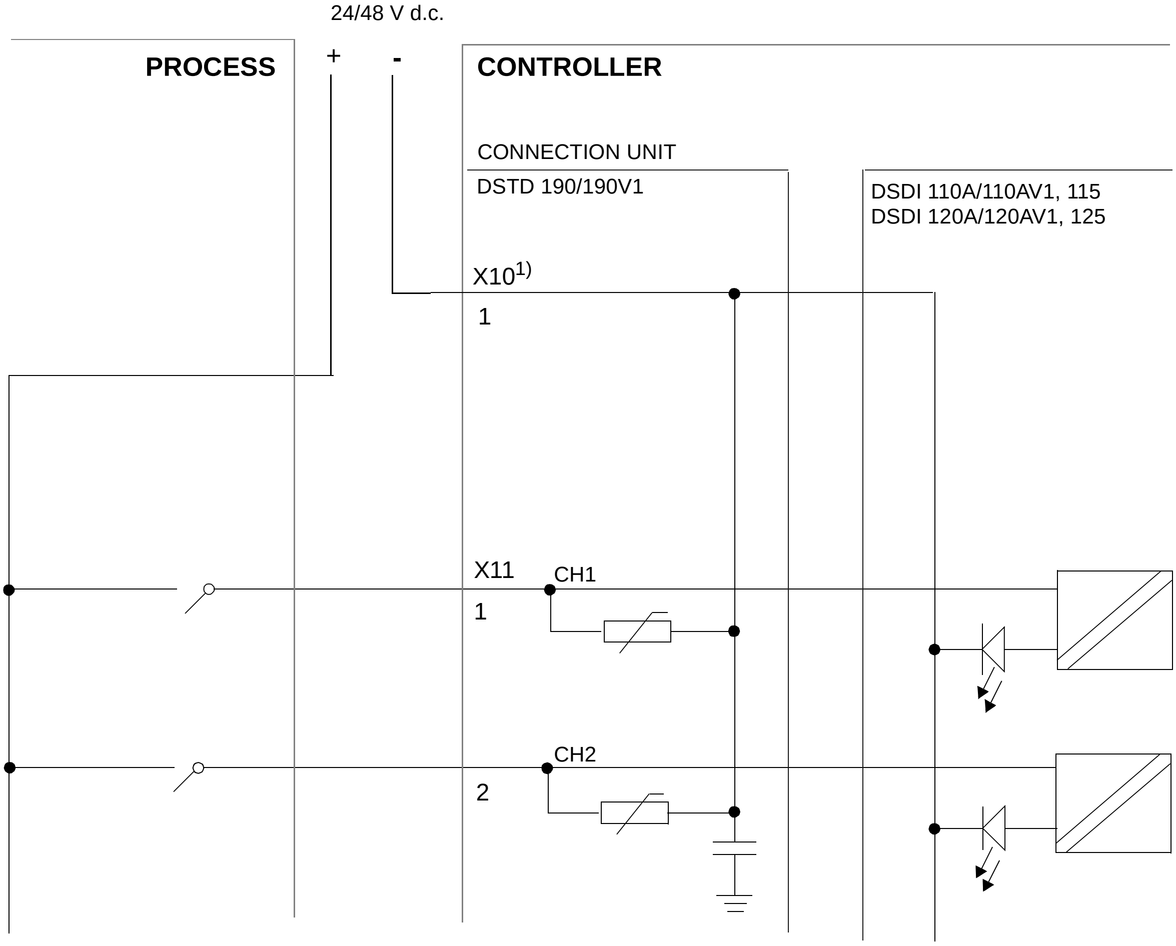


Figure 5-75. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115, DSDI 120A/DSDI 120AV1 and DSDI 125

1) A connecting bar is delivered with the unit and it can be used to connect the four groups in X10 to the same transducer power supply return.

Use the connection unit DSTD 196/DSTD 196P in combination with the boards DSDI 110A/DSDI 110AV1 and DSDI 115 for 24 V d.c. signals (see Figure 5-76). It is provided with eight screw terminals, which enable you to connect eight digital input signals and eight screw terminals for voltage distribution.

The inputs have, via resistors, an offset of -24 V to obtain 48 V over an open input.

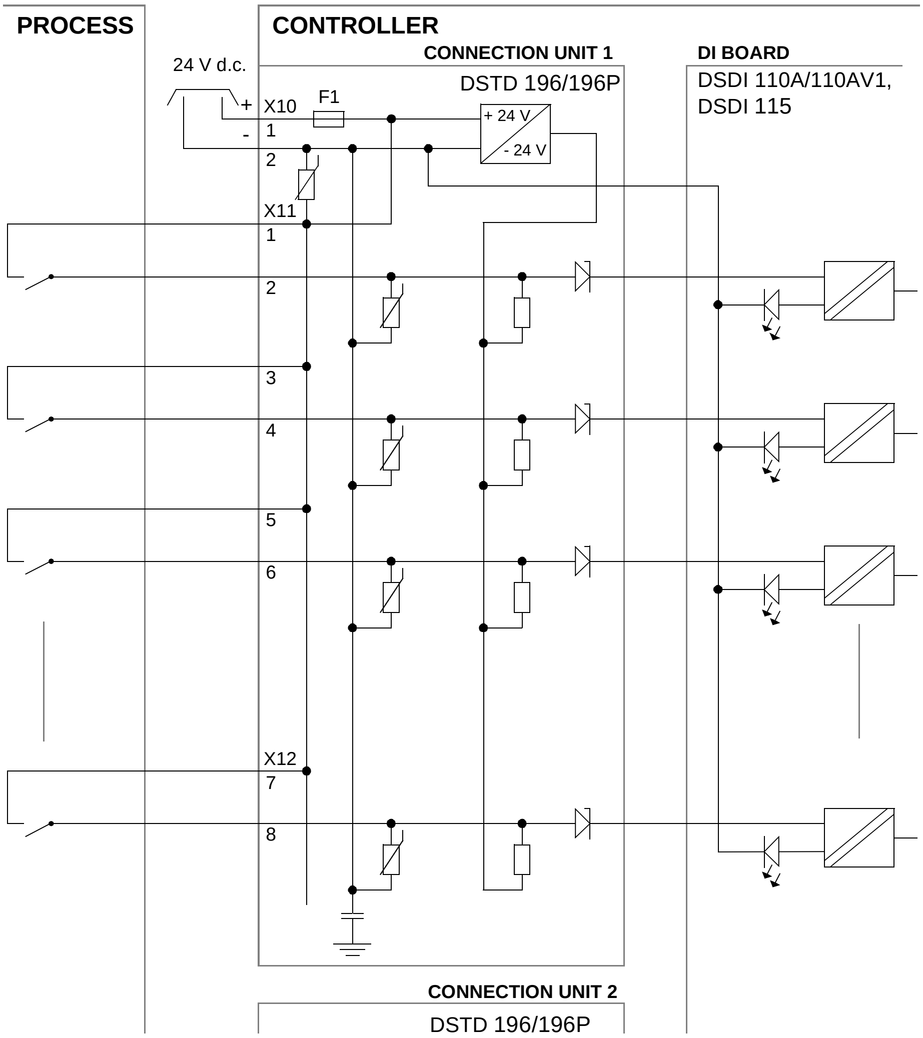


Figure 5-76. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115 with Connection Unit DSTD 196/ DSTD 196P

Use the eight channel connection units DSTD 195, DSTD 197 and DSTD 198 in combination with DSDI 110A/DSDI 110AV1 and DSDI 115.

Use DSTD 195 for 24 V a.c./d.c. signals, DSTD 197 for 120 V a.c./d.c signals and DSTD 198 for 230 V a.c. signals.

The inputs are opto-isolated from each other and from the system potential.

For connection examples of DSDI 110A/DSDI 110AV1, 115 with DSTD 195, DSTD 197 and DSTD 198, see Figure 5-77, Figure 5-78 and Figure 5-79.

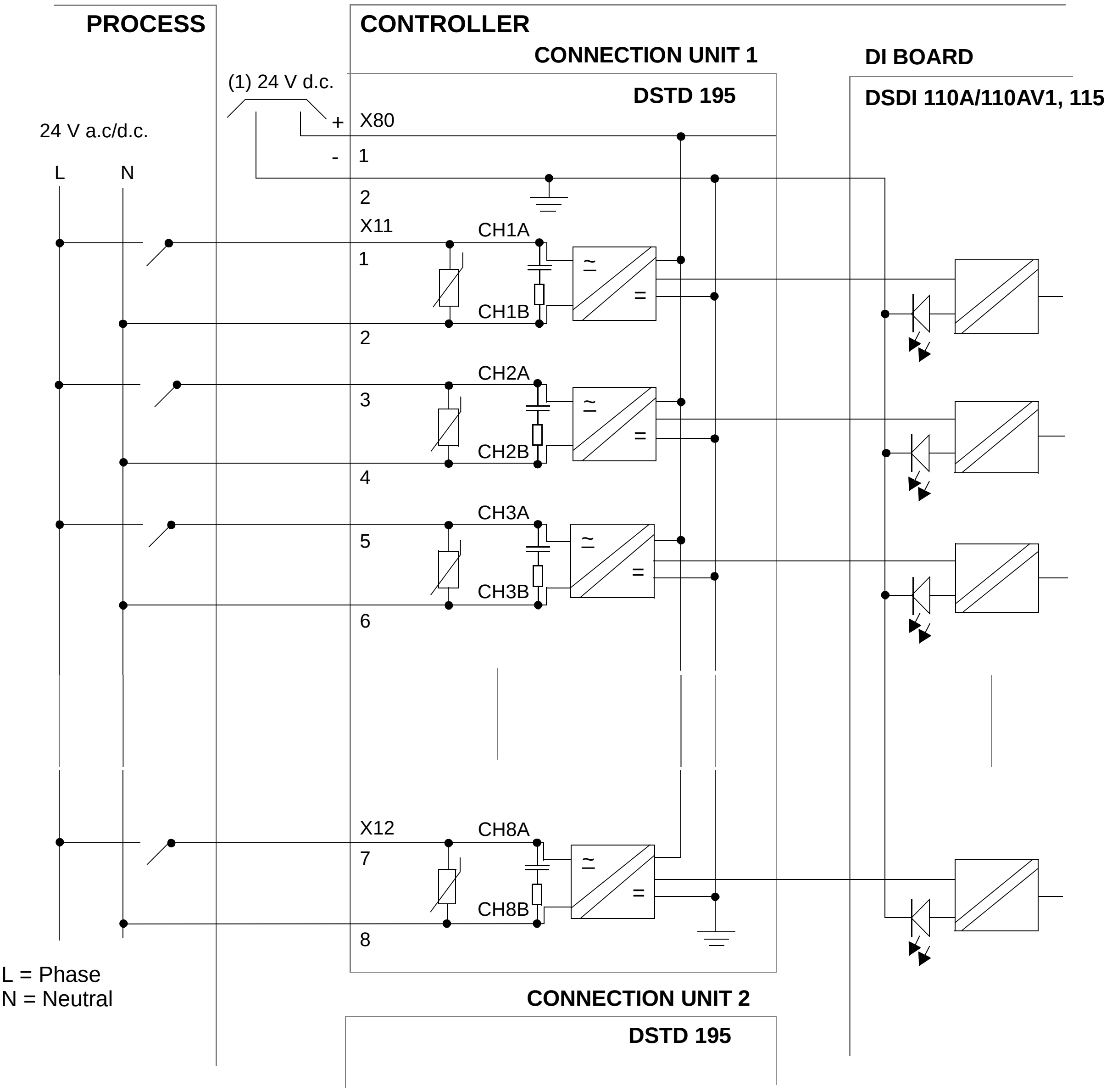


Figure 5-77. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115 to Connection Unit DSTD 195

1) Normally connected to the system internal 24 V.

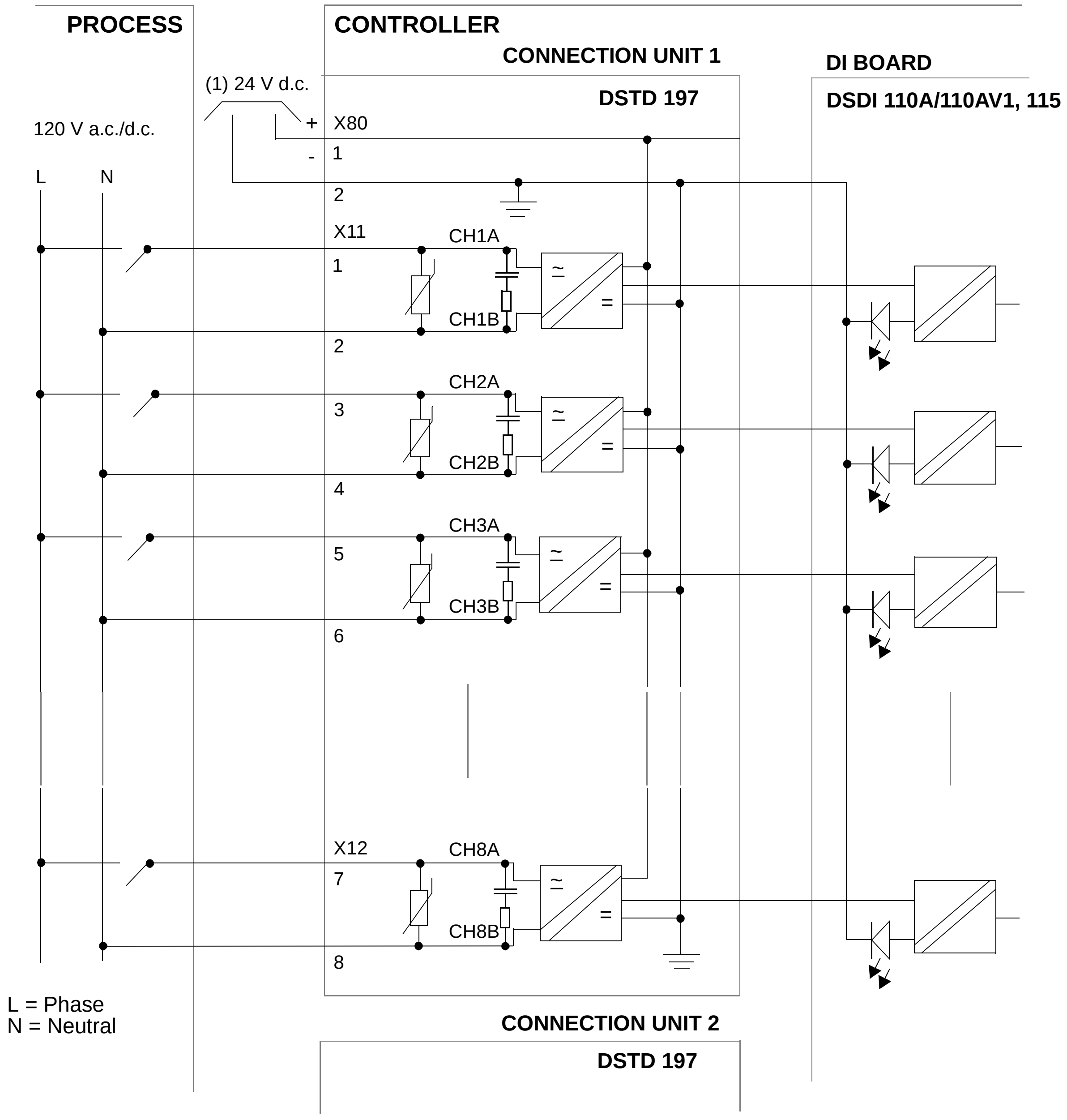


Figure 5-78. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115 to Connection Unit DSTD 197

1) Normally connected to the system internal 24 V.

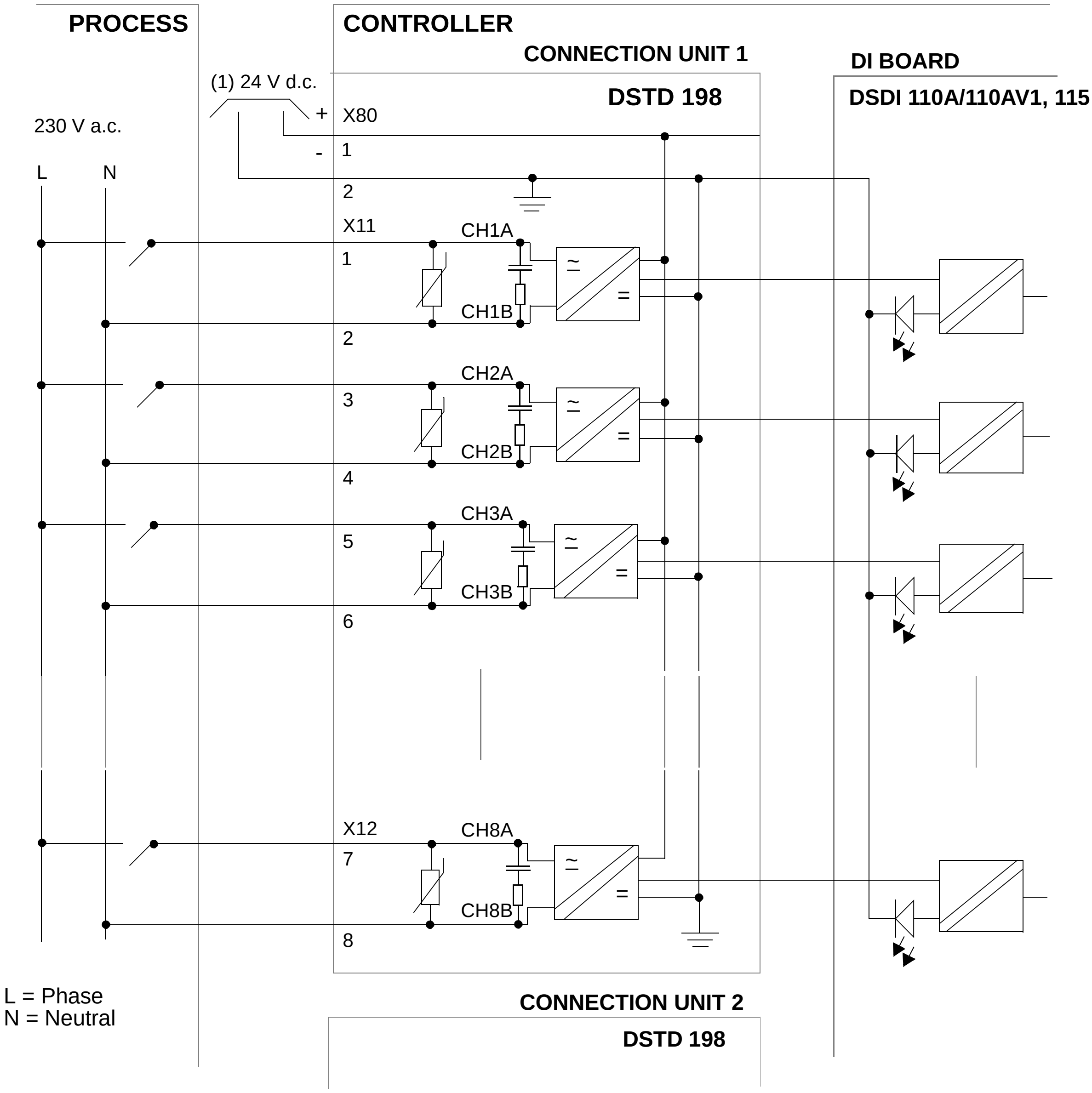


Figure 5-79. Example of Connection of Digital Input Board DSDI 110A/DSDI 110AV1, DSDI 115 to Connection Unit DSTD 198

1) Normally connected to the system internal 24 V.

You can combine connection units for different voltages freely, as shown in the picture below.

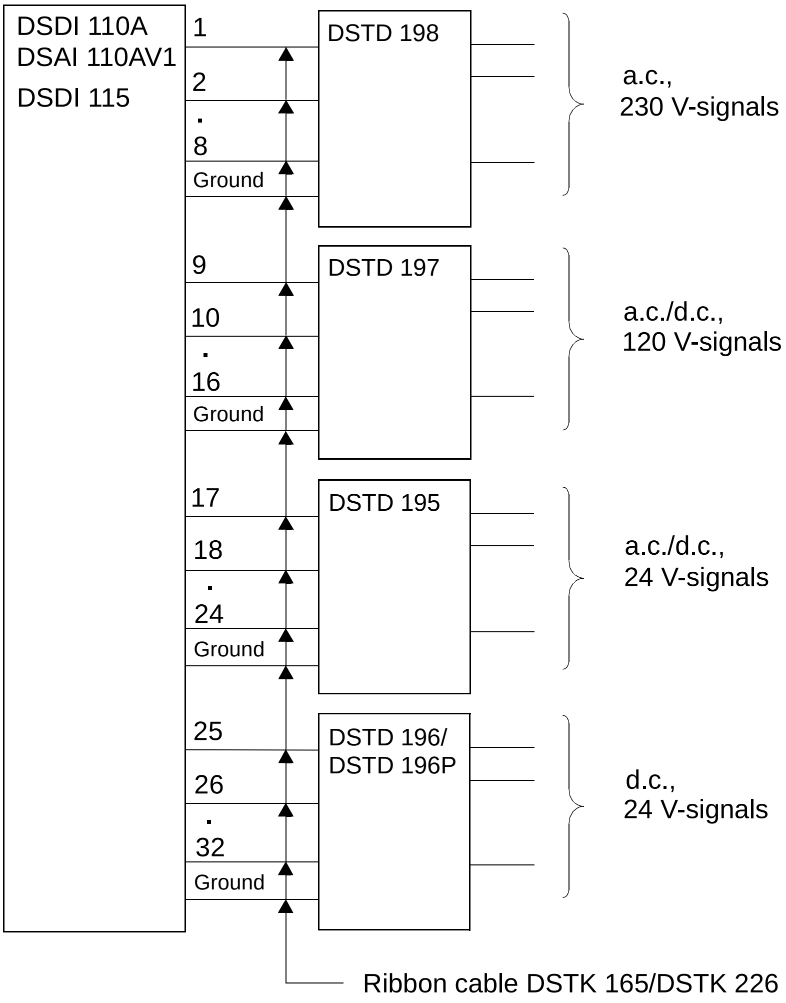


Figure 5-80. Connection Example for Digital Input Board DSDI 110A/DSDI 110AV1 and DSDI 115.

5.6.4 Jumpering of Connection Units for DI Boards

There are no jumpers on the connection units DSTD 150A, DSTD 190, DSTD 190V1 or DSTD 195 - 198. The following figures show the location of connectors and fuses on the connection units.

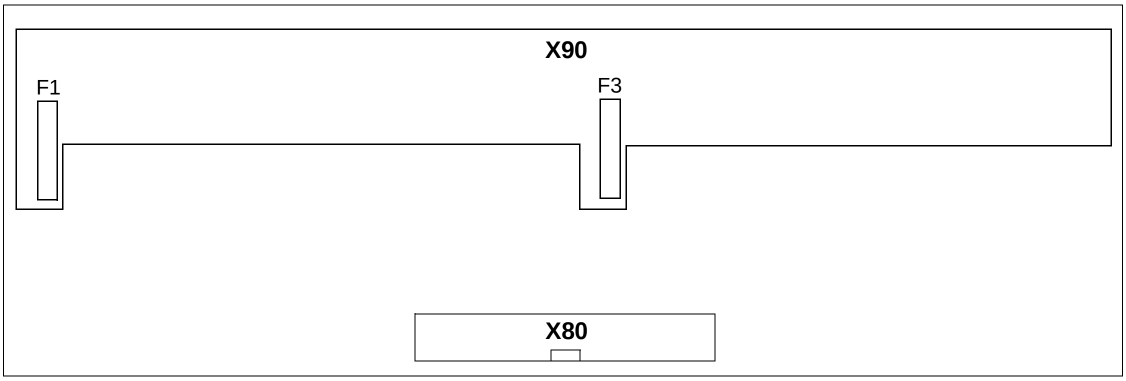


Figure 5-81. Connection Unit DSTD 150A, Location of Connectors and Fuses

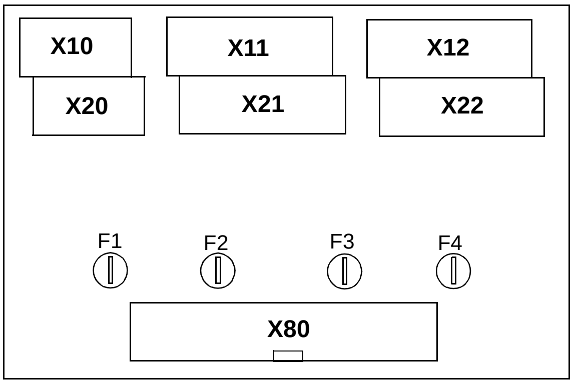


Figure 5-82. Connection Unit DSTD 190, Location of Connectors and Fuses

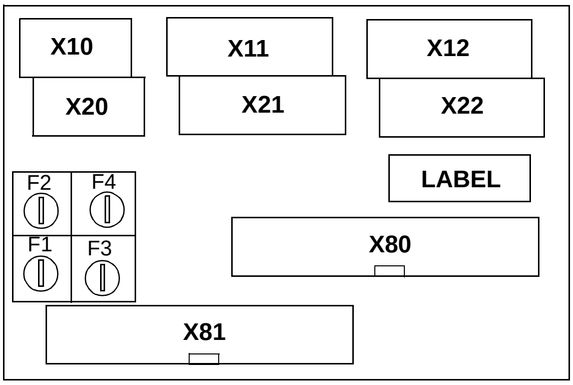


Figure 5-83. Connection Unit DSTD 190V1, Location of Connectors and Fuses

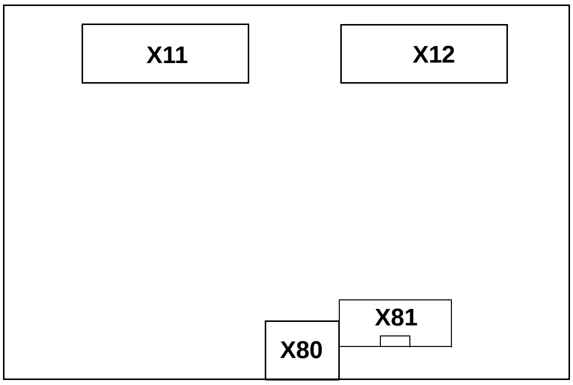


Figure 5-84. Connection Units DSTD 195, 197 and 198, Location of Connectors

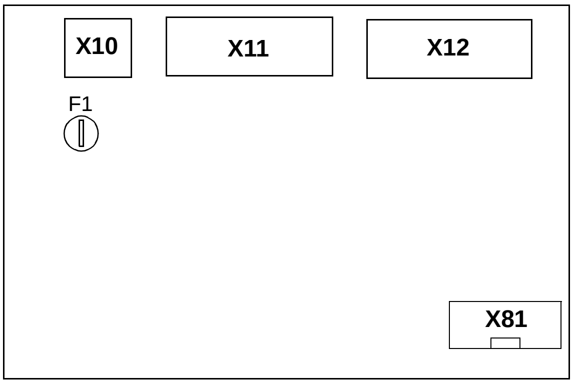


Figure 5-85. Connection Unit DSTD 196, Location of Connectors and Fuse

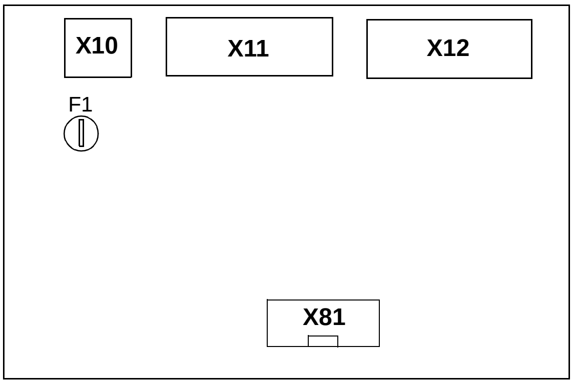


Figure 5-86. Connection Unit DSTD 196P, Location of Connectors and Fuse

5.7 Digital Output Boards (DSDO xxx)

The different types of digital output boards are intended for different signal voltages/currents and have 16 or 32 channels. The outputs are galvanically isolated by means of relays or opto-couplers. DSDO 115A output channels are group wise isolated into four groups with eight channels in each group.

Figure 5-87 shows the block diagram for a digital output signal.

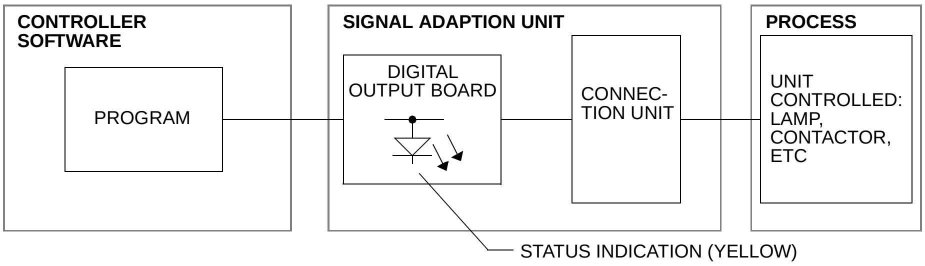


Figure 5-87. Digital Output Signal, Block Diagram

The circuit boards DSDO 110, DSDO 115/DSDO 115A and DSDO 120 have transistor outputs, DSDO 131 has relay outputs and DSDO 140 has triac outputs. On DSDO 131, the output channels are galvanically isolated with relays and, on the other boards, with opto-couplers.

The output circuits consist of a number of outputs with registers for output data. Logical “1” corresponds to an activated output.

The circuit boards also have circuits which reset all outputs to logical “0” when the voltage is switched on or if a voltage failure occurs during operation.

Depending on the current and voltage of the signals, you can combine the circuit boards and connection units in accordance with the following tables.

NOTE

For DSTD 108L, if the maximum load specified in the tables below is exceeded, the output may lose its low-current characteristics.

Table 5-54. Digital Output Boards, Key Data

Data	**DSDO 110/DSDO 115A + 4 x DSTD 108/DSTD 108L2)**		**DSDO 110/DSDO 115A + DSTD 14X5)**		
	DSTD 108/ DSTD 108P	**DSTD 108L/ DSTD 108LP2)**	**DSTD 145**	**DSTD 147**	**DSTD148**
	DSTK 165/DSTK 226				
Number of channels	32	32	8		
Galvanic isolation	4 x 8	4 x 8	8 x 16)		
Type of output	Relay	Relay	Relay		
Voltage rating	24 - 230 V d.c./a.c.	5 - 230 V d.c./a.c.	24- 230 V d.c./a.c.		

Table 5-54. Digital Output Boards, Key Data (Continued)

Data	**DSDO 110/DSDO 115A + 4 x DSTD 108/DSTD 108L**[2]		**DSDO 110/DSDO 115A + DSTD 14X**[5]		
	DSTD 108/ DSTD 108P	**DSTD 108L/ DSTD 108LP**[2]	**DSTD 145**	**DSTD 147**	**DSTD148**
	DSTK 165/DSTK 226				
Load supply: - Min - Max	 19.2 V d.c./a.c. 250 V d.c./a.c.	 5 V d.c./a.c. 250 V d.c./a.c.	 19.2 V d.c./a.c. 250 V d.c./a.c.		
Load current, maximum	3 A	200 mA (max 5 VA)	3 A		
Recommended load, minimum	100 mA @ 24 V or 2.5 VA	1 mA (min 0.05 VA)	100 mA @ 24 V or 2.5 VA		
Leak current, maximum	1.5 mA @ 220 V a.c.[3]	1.5 mA @ 220 V a.c.[3]	1.5 mA @ 220 V a.c.		
Voltage drop with max load	-	-	-		
Switch on current during 50 ms/s	2000 VA (max 10 A)	5 VA max 200 mA)	2000 VA (max 10 A)		
Max break power a.c. cos $\Phi > 0.4$	720 VA	5 VA	720 VA		
Max break power d.c. L/R < 40 ms	44 W	5 W	44 W		
Insulation test voltage 50 Hz for one minute	2 kV	2 kV	2 kV		
Current consumption, +5 V, typ.	0.65 A	0.65 A	0.65 A		
Current consumption, +24 V, typ.	22 mA/channel	22 mA/channel	22 mA/channel		
Total power dissipation, typical[1]: DSDO 11x + 4 x DSTD 108/DSTD 108L/ 1xDSTD14X	 4.3 W 10 W	 4.3 W 10 W	 4.3 W 2.5 W		
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV[4]	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 2.5 kV		

1) The power dissipation is calculated with 70 percent of the channels activated and loaded with 50 percent of the maximum load.
2) DSTD 108L is used for low current loads.
3) RC-element over relay contact 100 Ω/22 nF
4) CMV = Common Mode Voltage, NMV = Normal Mode Voltage
5) Object oriented connection units.
6) 8 objects with one digital output on each object

Table 5-55. Digital Output Boards, Key Data

Data	**DSDO 115**	**DSDO 115**	**DSDO 115A**	**DSDO 115A**	**DSDO 120**
	DSTD 110A	**DSTD 190/ DSTD 190V1**	**DSTD 190V1**	**4x DSTD 109P**	**DSTD 120A**
	DSTK 165/ DSTK 221	**DSTK 165/ DSTK 221**	**DSTK 234**	**DSTK 165/ DSTK 221**	**DSTK 110/ DSTK 220**
Number of channels	32	32	32	32	16
Galvanic isolation	2 x 16	4 x 8	4 x 8	4 x 8	2 x 8
Type of output	Opto-isolated short-circuit protected transistor output	Opto-isolated short-circuit protected transistor output	Group wise isolated into four groups.	Group wise isolated into four groups.	Opto-isolated transistor output
Voltage rating	24 V d.c.	24 V d.c.	24 V d.c.	24 V d.c.	24/48 V d.c.
Load supply: - Min - Max	 19.2 V d.c. 33 V d.c.	 19.2 V d.c. 33 V d.c.	 19.2 V d.c. 33 V d.c.	 19.2 V d.c. 33 V d.c.	 19.2 V d.c. 60 V d.c.
Load current, maximum	150 mA	150 mA	0.5A	2 A	1 A
Recommended load, minimum	-	-	-	-	-
Leak current, maximum	0.1 mA @ 33 V	0.1 mA @ 33 V	0.1 mA @ 33 V	0.1 mA @ 33 V	0.1 mA @ 60 V
Voltage drop with max load	2.6 V	2.6 V	2.6 V	2.6 V	1.6 V
Switch on current during 50 ms/s	-	-	-	-	6 A
Max break power a.c. cos $\Phi > 0.4$	-	-	-	-	-
Max break power d.c. L/R < 40 ms	-	-	-	-	-
Insulation test voltage 50 Hz for one minute	500 V	500 V	500 V	500 V	500 V
Current consumption, +5 V, typ.	0.65 A	0.65 A	0.65 A	0.65 A	0.65 A
Current consumption, +24 V, typ.	-	-	-	-	-

Table 5-55. Digital Output Boards, Key Data (Continued)

Data	**DSDO 115**	**DSDO 115**	**DSDO 115A**	**DSDO 115A**	**DSDO 120**
	DSTD 110A	**DSTD 190/ DSTD 190V1**	**DSTD 190V1**	**4x DSTD 109P**	**DSTD 120A**
	DSTK 165/ DSTK 221	**DSTK 165/ DSTK 221**	**DSTK 234**	**DSTK 165/ DSTK 221**	**DSTK 110/ DSTK 220**
Total power dissipation, typical1): DSDO 11x	7.7 W	7.7 W	11 W	11 W	12 W
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV2)	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV	yes 5 kV 2.5 kV / 2.5 kV	yes 3 kV 2.5 kV / 2.5 kV

1) The power dissipation is calculated with 70% of the channels activated and loaded with 50% of the maximum load.
2) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

Table 5-56. Digital Output Boards, Key Data

Data	**DSDO 131**	**DSDO 140**
	DSTD 1311)	**DSTD 1311)**
	DSTK 110	
Number of channels	16	16
Galvanic isolation	2 x 8	2 x 8
Type of output	Relay	Opto-isolated triac output
Voltage rating	24 - 230 V d.c./a.c.	48 - 230 V a.c.
Load supply: - Min - Max	 19.2 V d.c./a.c. 250 V d.c./a.c.	 40 V a.c. 250 V a.c.
Load current, max	3 A	1 A
Recommended load, minimum	100 mA @ 24 V or 2.5 VA	20 mA
Leak current, maximum	3.2 mA @ 220 V a.c.3)	4.5 mA @ 220 V a.c.
Voltage drop with max load	-	1.5 V
Switch on current during 50 ms/s	2000 VA (max 10 A)	6 A
Max break power a.c., cos $\Phi > 0.4$	720 VA	-
Max break power d.c., L/R < 40 ms	44 W	-
Insulation test voltage 50 Hz for one minute	2 kV (excl. decoupling capacitor, otherwise 2 kV - 1 sec)	2 kV (excl. decoupling capacitor, otherwise 2 kV - 1 sec)

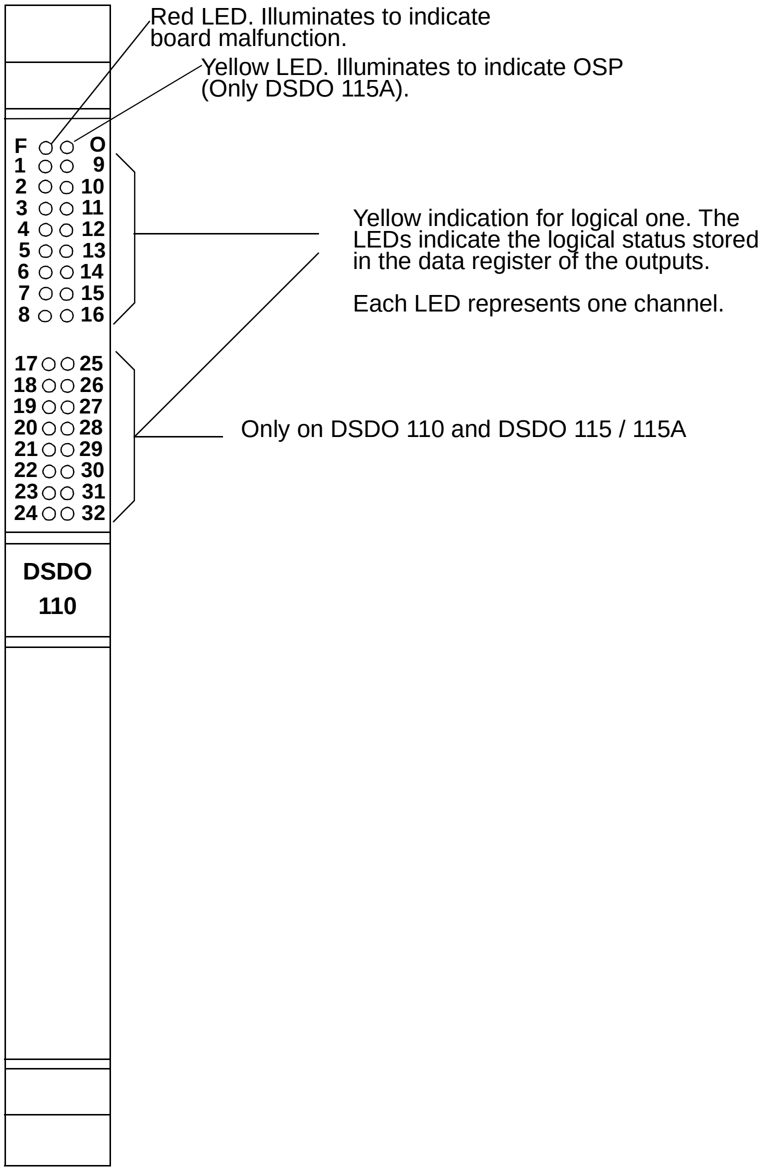
Table 5-56. Digital Output Boards, Key Data (Continued)

Data	**DSDO 131**	**DSDO 140**
	DSTD 131[1]	**DSTD 131**[1]
	DSTK 110	
Current consumption, +5 V, typ.	0.65 A	0.65 A
Current consumption, +24 V, typ.	25 mA/channel	-
Total power dissipation, typical[2]:	12 W	12 W
Interference immunity in acc. with: - EN 50082-2 - IEC 255-4 impulse - IEC 255-4 1 MHz CMV/NMV[4]	 yes 5 kV 2.5 kV / 2.5 kV	 yes 5 kV 2.5 kV / 1 kV

1) All channels fused separately.
2) The power dissipation is calculated with 70% of the channels activated and loaded with 50% of the maximum load.
3) RC-element over relay contact 47 Ω/47 nF
4) CMV = Common Mode Voltage, NMV = Normal Mode Voltage

5.7.1 Front Panels

The front panel of the DSDO boards is shown in Figure 5-88. Approximately the same figure applies for all boards. Signal status is indicated with yellow LEDs (one per signal). Board fault is indicated with a red LED “F”. The LED “F” can also be activated by the controller software.



Red LED. Illuminates to indicate board malfunction.

Yellow LED. Illuminates to indicate OSP (Only DSDO 115A).

Yellow indication for logical one. The LEDs indicate the logical status stored in the data register of the outputs.

Each LED represents one channel.

Only on DSDO 110 and DSDO 115 / 115A

Figure 5-88. Front Panel of DSDO 110, DSDO 115, DSDO 115A, DSDO 120, DSDO 131 and DSDO 140

5.7.2 Jumpering of DO Boards

Digital output board DSDO 110, 115, 120, 131, 140 have one switch group, S1, for address setting. The location of the switch group is found in Figure 5-89. The address range for digital output boards is H’90 - H’BF (H’ = hexadecimal notation), which corresponds to the range 144 - 191 in decimal notation.
See Appendix A Address Jumpering for examples of address jumpering.

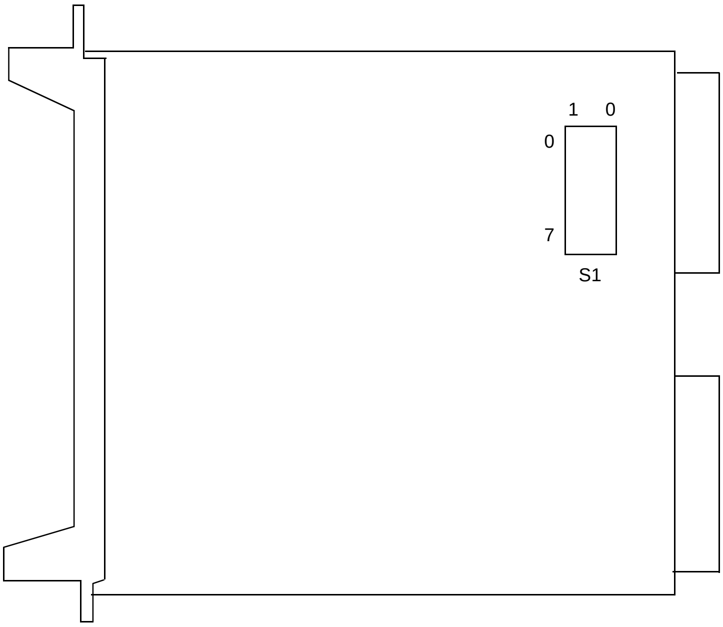


Figure 5-89. Digital Output Boards DSDO 110, 115, 120, 131 and 140, Location of Switch Groups

Digital output board DSDO 115A have two switch groups S! for address setting and X5 for Inhibit. The location of the switch group se Figure 5-81. The address range for digital output boards is H’90 - H’BF (H’ = hexadecimal notation), which corresponds to the range 144 - 191 in decimal notation.
See Appendix A Address Jumpering for examples of address jumpering.

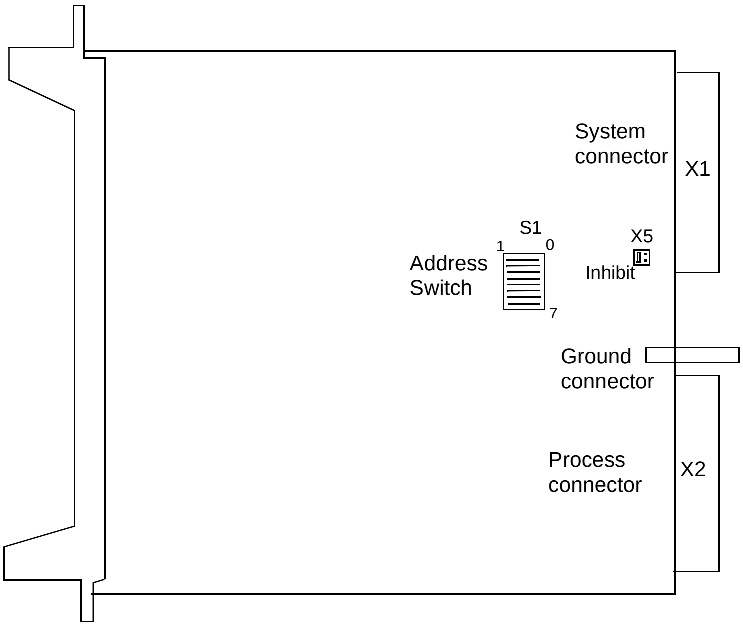


Figure 5-90. Digital Output Boards DSDO 115A, Location of Switch Groups

Inhibit switch

If the Inhibit goes active the normal program execution stops and the outputs deactivate or goes to their predetermined value OSP. Taking the jumper X4 away prevents the board from react on an active Inhibit signal and the output signal will be hold. The jumper shall normally be mounted in normal position.

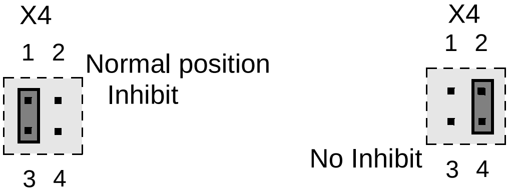


Figure 5-91. Inhibit Switch

5.7.3 Jumpering of Connection Units for DO Boards

There are no jumpers on the connection units for DO boards except DSTD 108P/DSTD 108LP and DSTD 109P. The following figures show the location of connectors and fuses on the connection units.

5.7.4 Connection of DO Boards to the Process (DSTD xxx)

Key data for the connection units DSTD 108/DSTD 108P, DSTD 108L/DSTD 108LP, DSTD 109P, DSTD 110A, DSTD 120A, DSTD 131, DSTD 145, DSTD 147, DSTD 148 and DSTD 190, DSTD 190V1 intended for digital output signals, are shown in the table below.

For more information about object oriented connection unit refer to Section 5.8 Object Oriented Connection Units for Digital Signals.

Table 5-57. Key Data of the Connection Units

Data	**DSTD 108xx**	**DSTD 109P**	**DSTD 110A**	**DSTD 120A**	**DSTD 131**	**DSTD 145**[2)]	**DSTD 147**[2)]	**DSTD 148**[2)]	**DSTD 190**	**DSTD 190V1**
Number of channels	8	8	32	16	16	8	8	8	32	32
Fuses (glass tube 20 x 5.0 mm)	-	-	F1, F3 2 A (fast)	F1, F3 6.3 A (fast)	F1 - F16[1)] 3.5 A (fast)	--	-	-	F1 - F4 2 A (fast)	F1 - F4 6.3 A (fast)
Voltage range, max	250 V	24 V	60 V	60 V	250 V	250 V	250 V	250 V	60 V	60V
Cable to DSDO	DSTK 165/ DSTK 226	DSTK 226	DSTK 150/ DSTK 221	DSTK 110	DSTK 110	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 165/ DSTK 226	DSTK 150/ DSTK 221	DSTK 234
Process connection	16	20	32	32	32	16	16	16	32	32
Voltage distribution connections	-	-	14	8	12	-	-	-	8	8
Cable area (screw terminals)	0.5 - 2.5 mm^2									

1) Each output is fused separately
2) Object Oriented Connection Unit

All of the channels on the connection units are provided with interference voltage limiters. Fusing possibilities are provided on most of the connection units.

The outputs are provided with diodes (transistor outputs) or RC links (relay outputs) to suppress voltages generated when inductive loads are disconnected.

Some terminal blocks for connection of installation leads from the process are disconnect able so you can isolate the outputs during testing.

In general, supply and return leads for the signals should be routed in the same cable and connected to connection units for effective suppression of interferences.

NOTE

> For the connection units DSTD 110A, DSTD 120A and DSTD 190/ DSTD 190V1, it is a functional requirement that the supply and return leads for the process signals be routed in the same cable and connected to the connection unit.

Connection examples for digital output signals are shown in Figure 5-92.

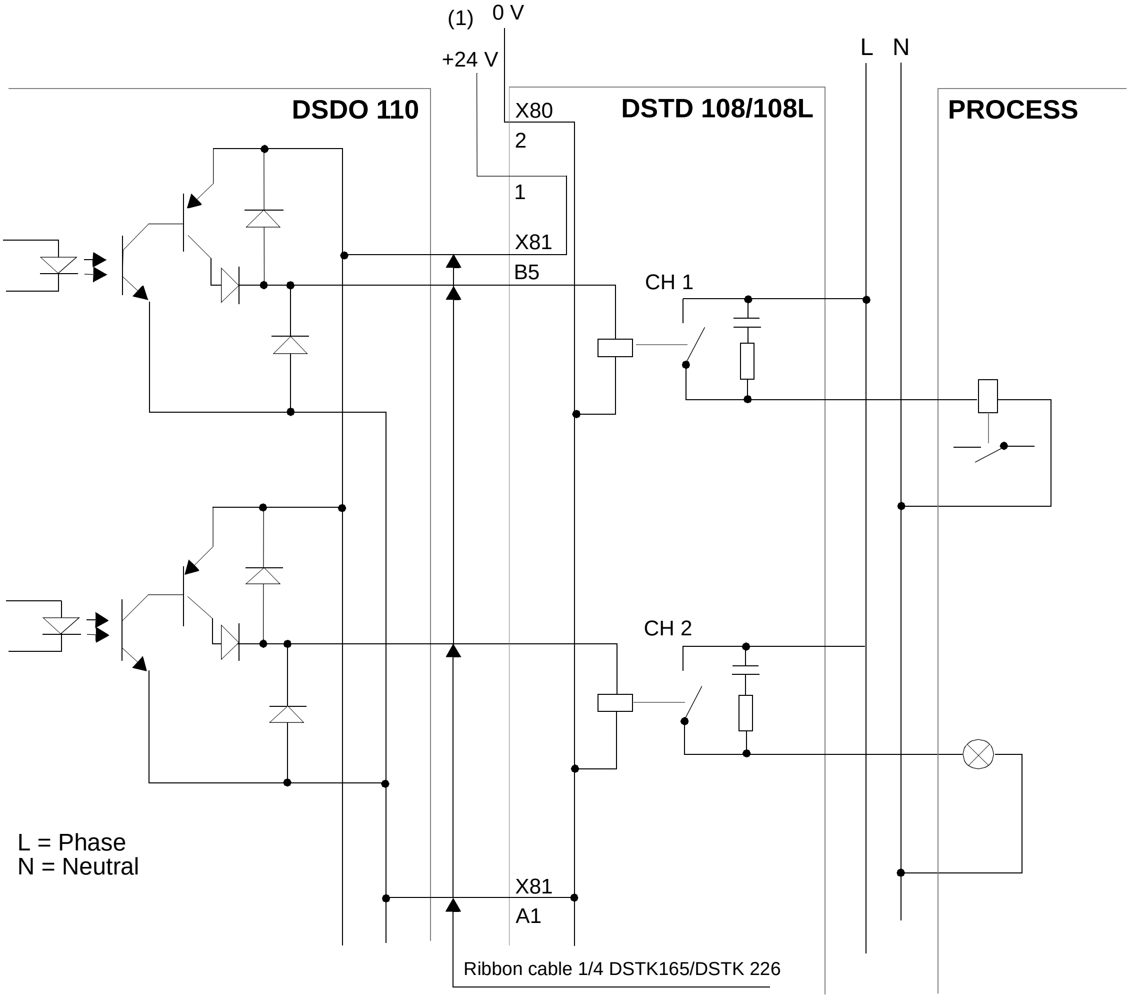


Figure 5-92. Examples of Connection of DSDO 110/DSDO 115/DSDO 115A to DSTD 108/DSTD 108L/DSTD 108P/ DSTD 108LP

1) Normally connected to the system internal 24 V.

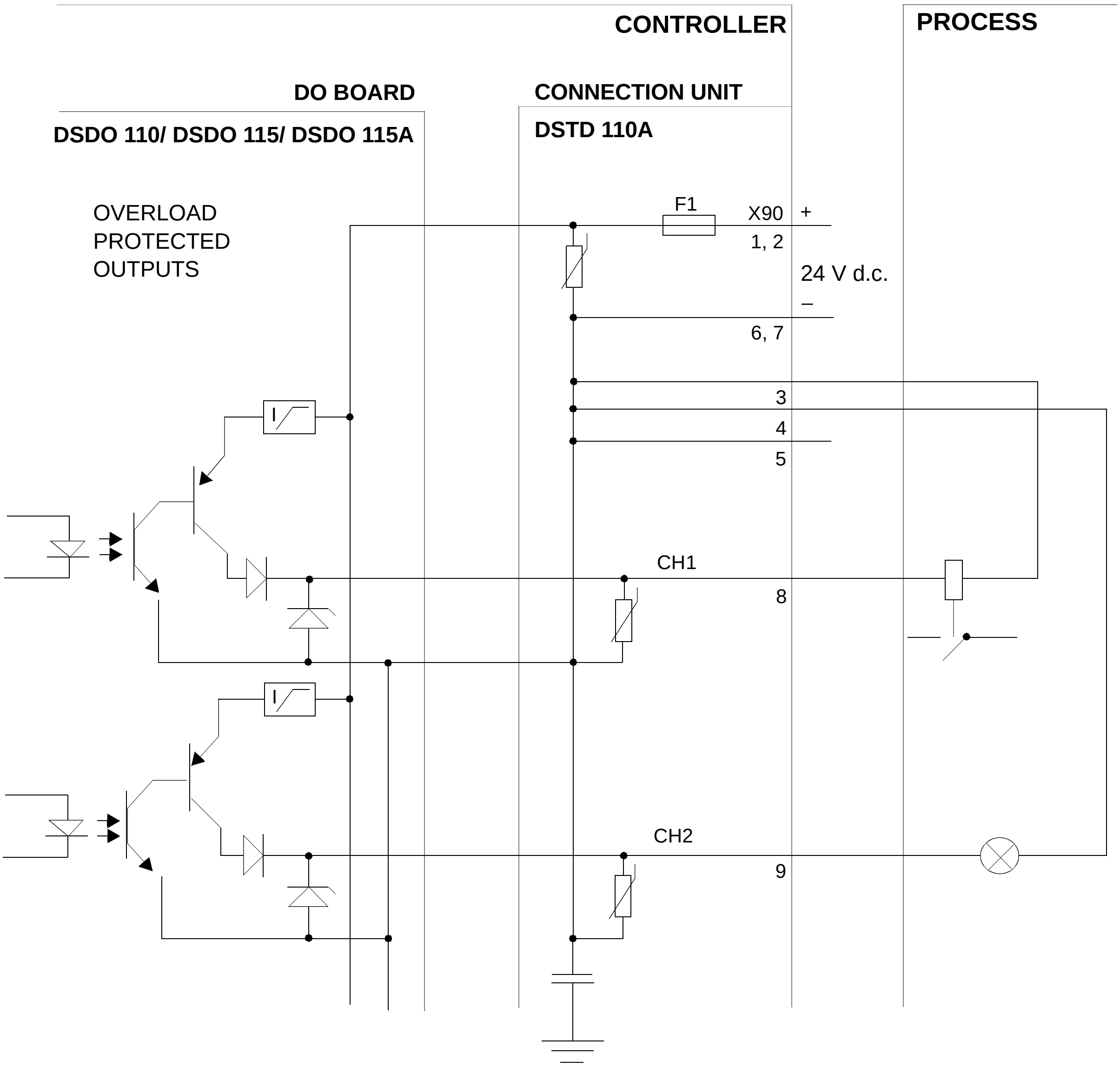


Figure 5-93. Example of Connection of DSDO 110/ DSDO 115/ DSDO 115A

The connection unit DSTD 190 for DSDO 115/DSDO 115A (see the figure below) is provided with screw terminals, which enable you to connect 32 digital output signals. The channels are divided into four groups of eight channels. Each group is fused.

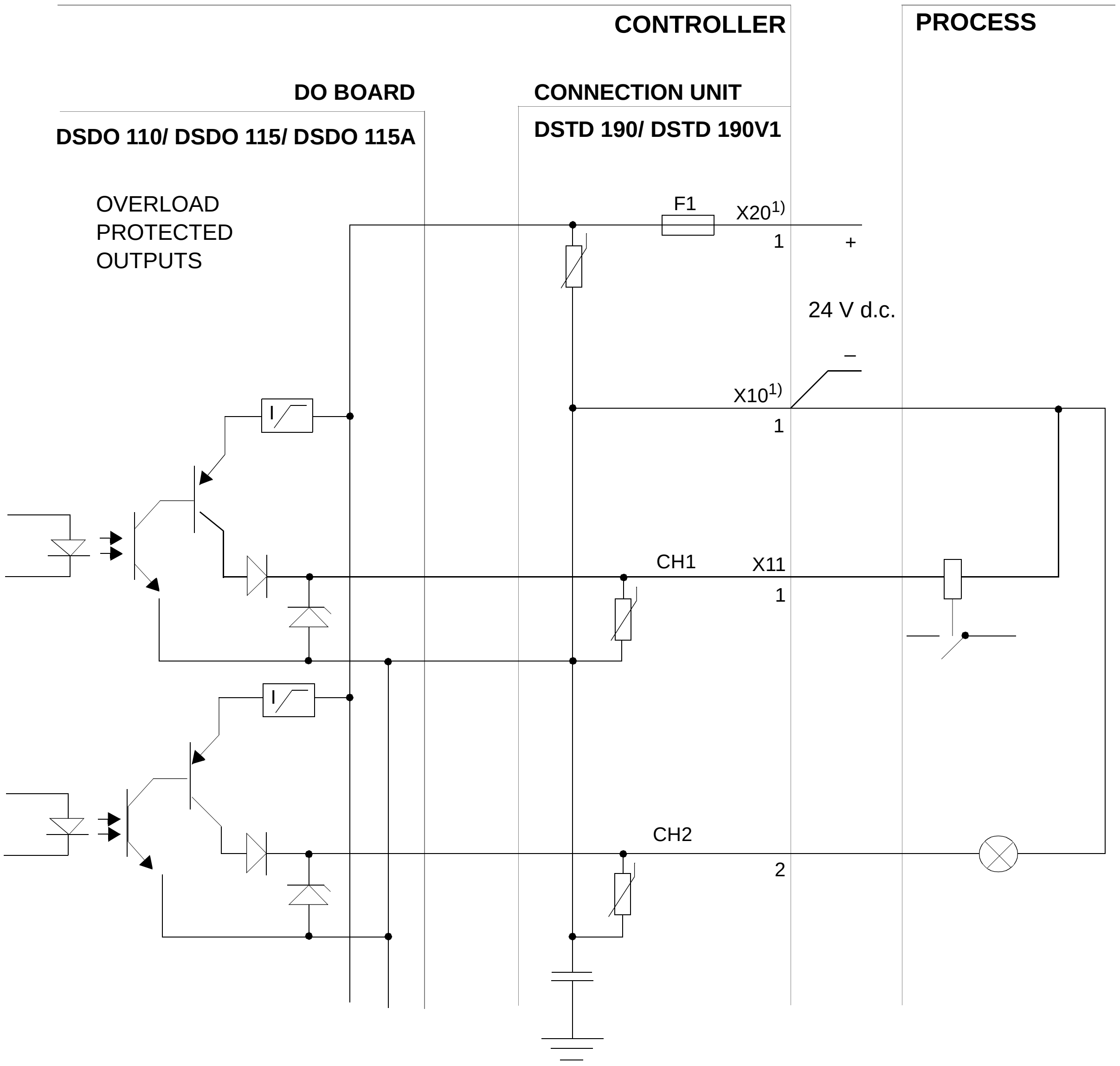


Figure 5-94. Example of Connection of DSDO 110/ DSDO 115/DS/ DO 115A

1) A pair of connecting bars are delivered with the unit and they can be used to connect the four groups in X10 respective X20 to the same power supply.

In special cases where individual signals require voltages up to 250 V, you can use DSTD 108/DSTD 108L in combination with DSTD 110A or DSTD 190/ DSTD 190V1. (See Figure 5-95 below.)

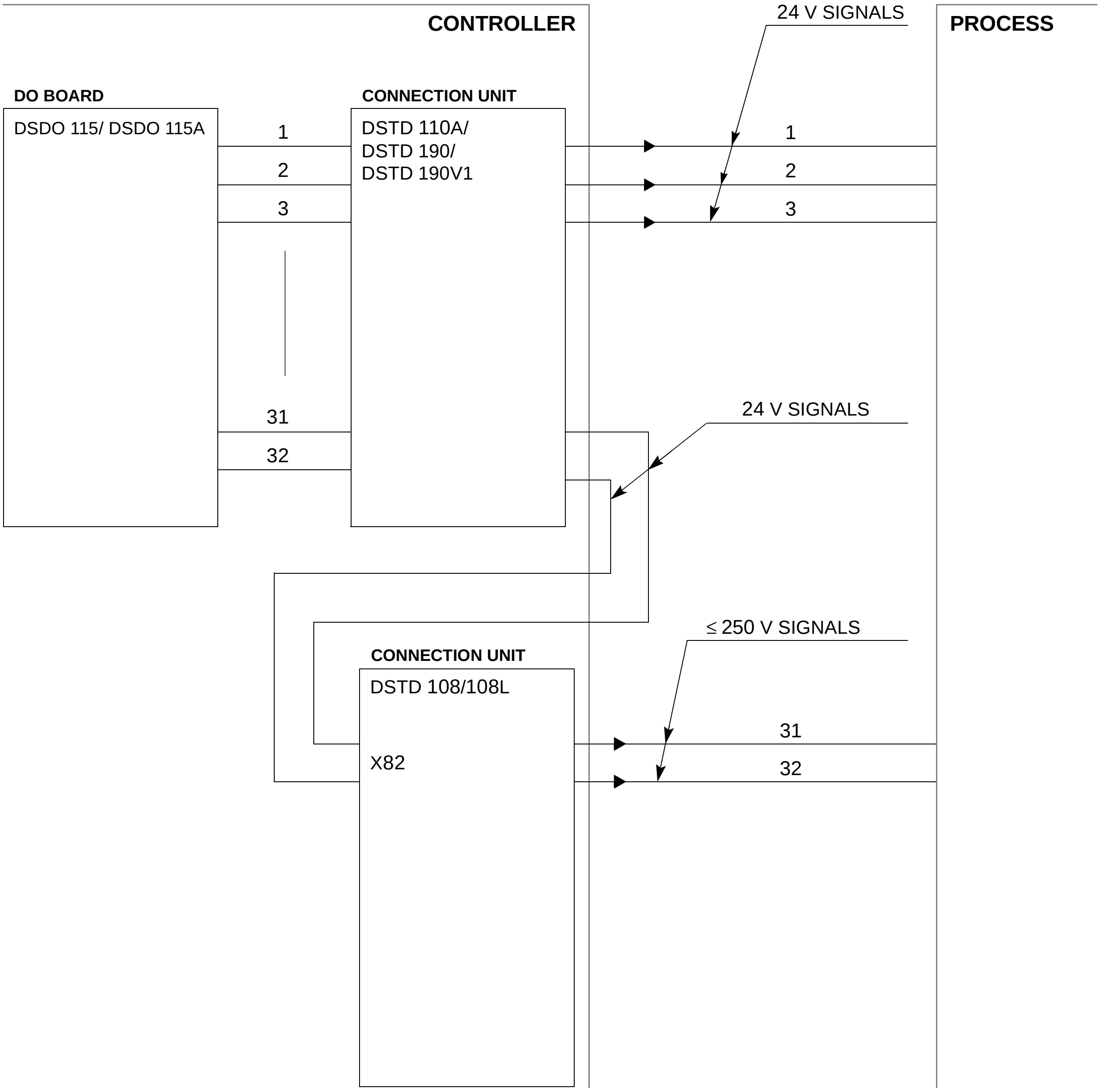


Figure 5-95. Example of Typical Connection of Individual Signals to DSTD 108/DSTD 108L

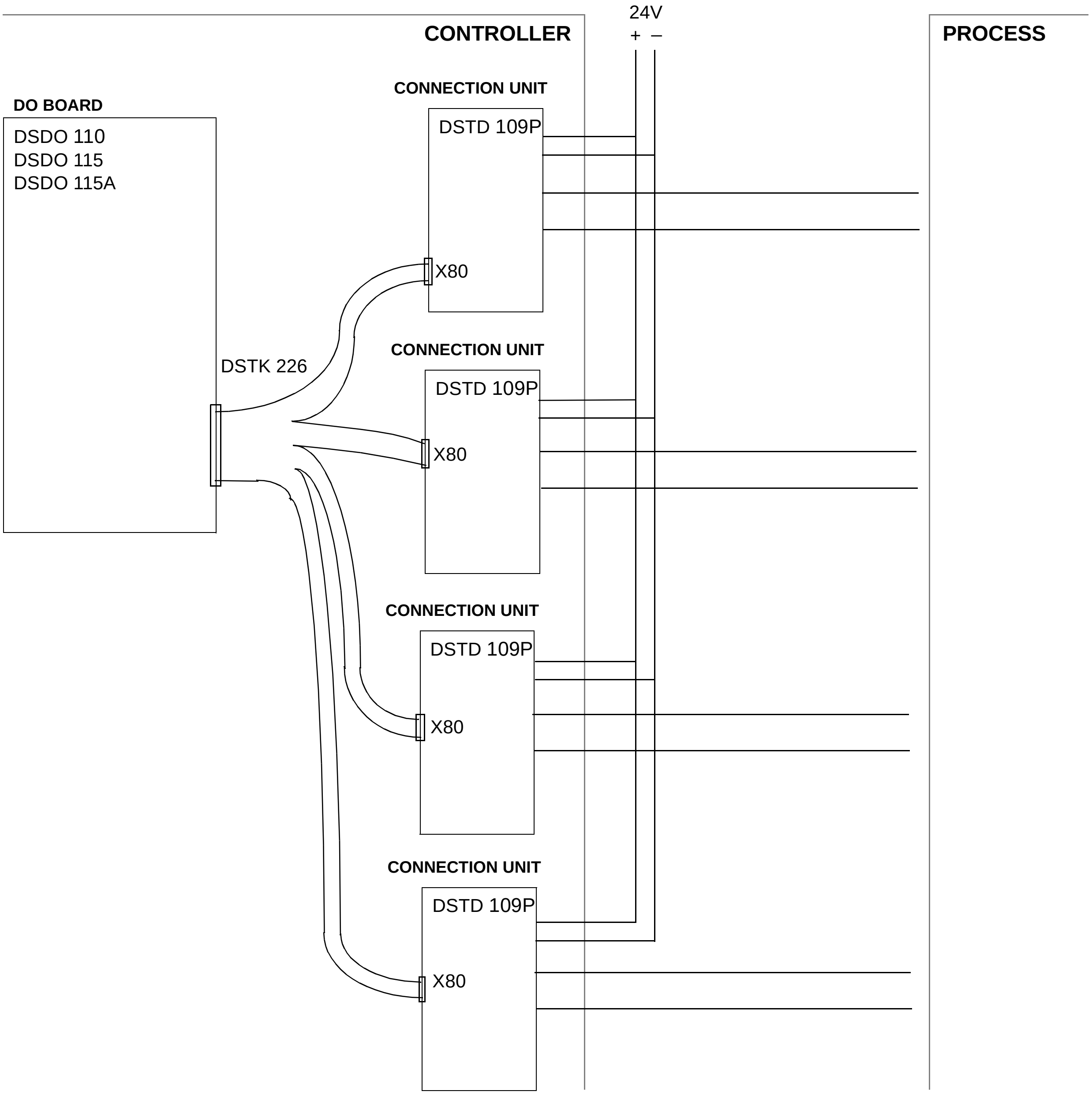


Figure 5-96. Example of Typical Connection of 4 DSTD 109P

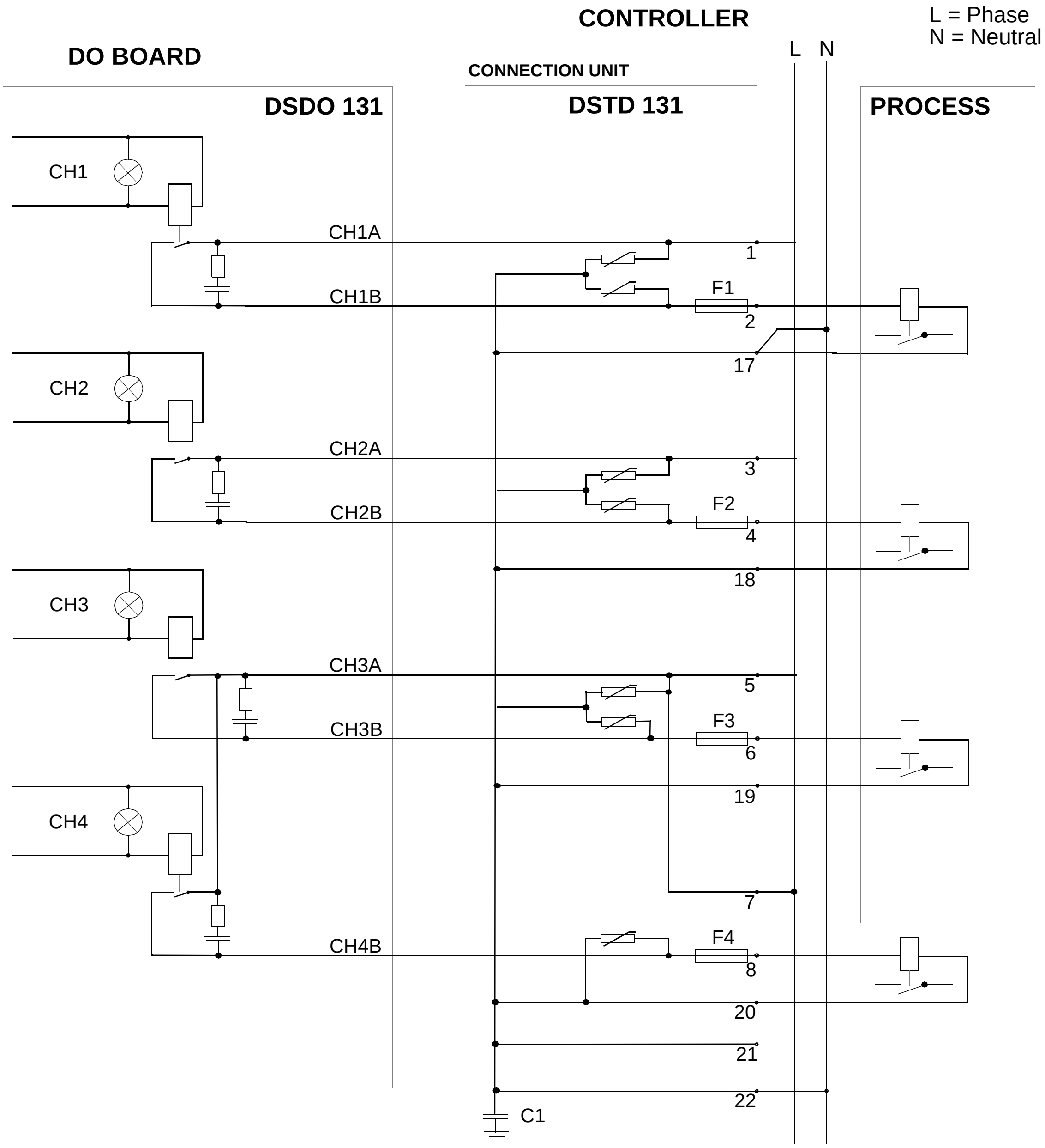


Figure 5-97. Examples of Typical Connection of DSDO 131

For jumpering of object oriented DO connection units refer to Section 5.8 Object Oriented Connection Units for Digital Signals.

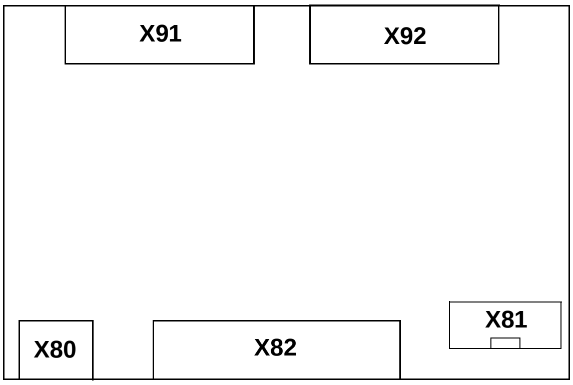


Figure 5-98. Connection Unit DSTD 108/DSTD 108L, Location of Connectors

The +24V return (ZP) can be connected to the chassis via the screw mounting holes. This is accomplished by using the strap switch S1.

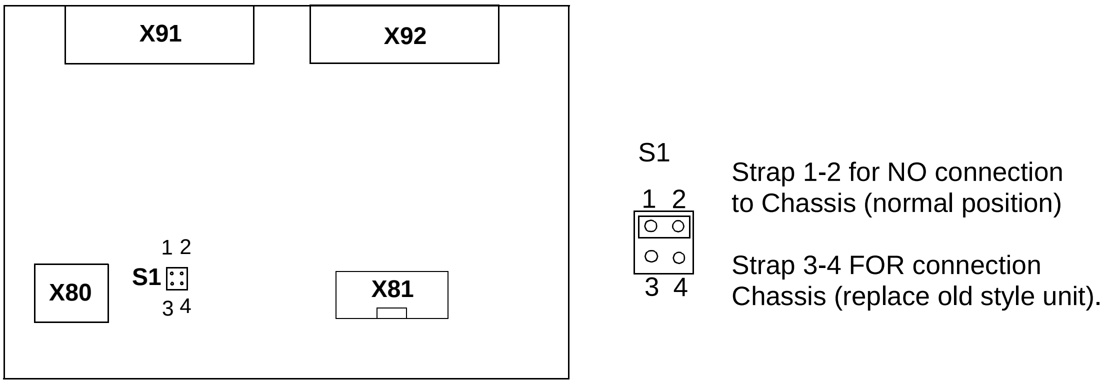

X91
X92
1 2
S1
3 4
X80
X81
S1
1 2
3 4
Strap 1-2 for NO connection
to Chassis (normal position)
Strap 3-4 FOR connection
Chassis (replace old style unit).

Figure 5-99. Connection Unit DSTD 108P/DSTD 108LP, Location of Connectors

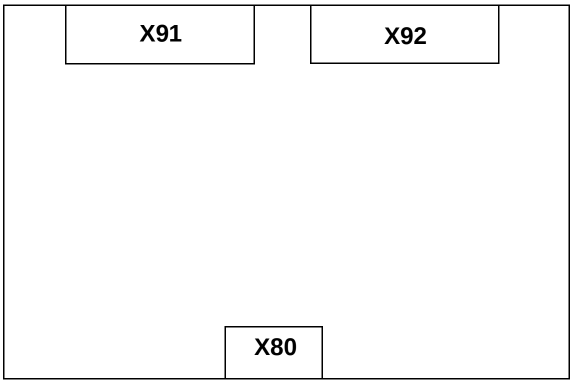


Figure 5-100. Connection Unit DSTD 109P, Location of Connectors

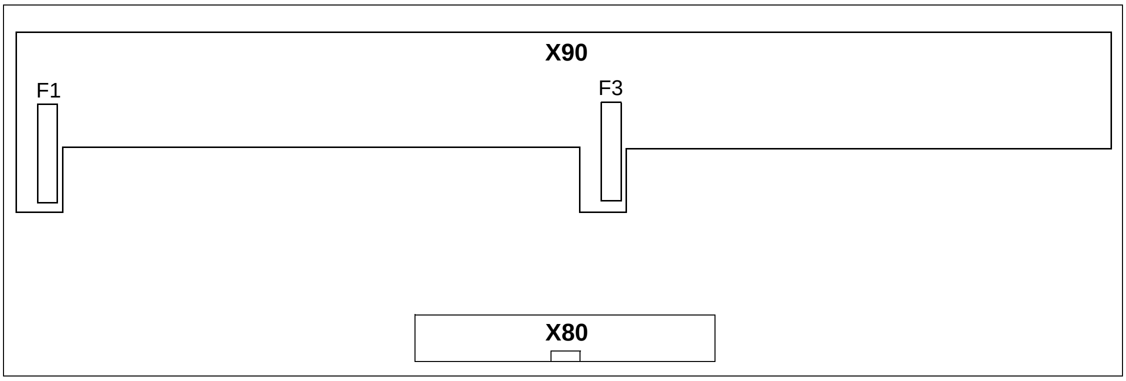


Figure 5-101. Connection Unit DSTD 110A, Location of Connectors and Fuses

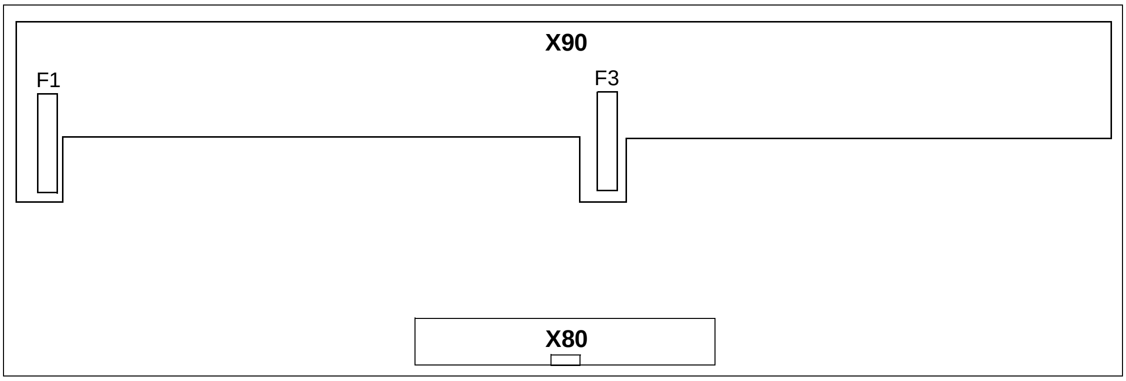


Figure 5-102. Connection Unit DSTD 120A, Location of Connectors and Fuses

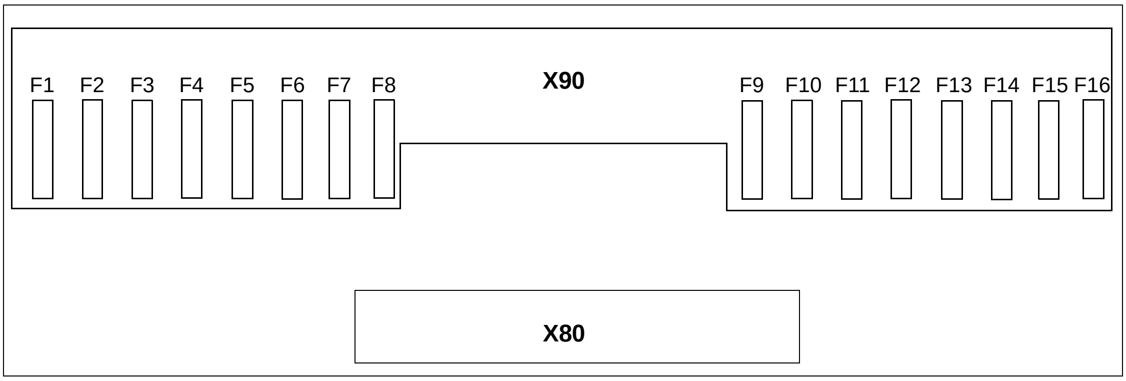


Figure 5-103. Connection Unit DSTD 131, Location of Connectors and Fuses

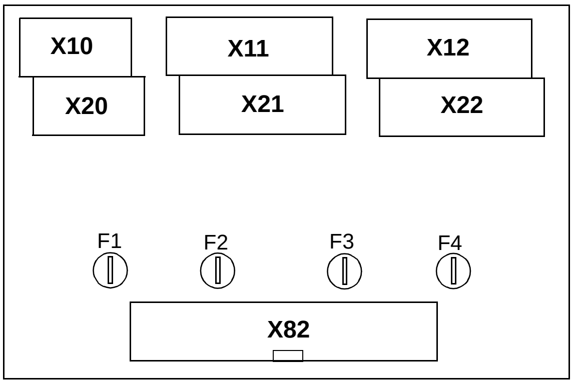


Figure 5-104. Connection Unit DSTD 190, Location of Connectors and Fuses

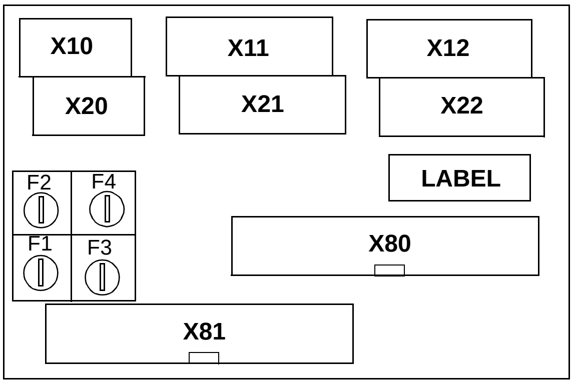


Figure 5-105. Connection Unit DSTD 190V1, Location of Connectors and Fuses

5.8 Object Oriented Connection Units for Digital Signals

5.8.1 Features in DSTD 145, DSTD 147, DSTD 148

The Object Oriented Connection Units DSTD 145, DSTD 147, and DSTD 148 gives the following features:

- Plug- in connector for each object.
- Object marking facilities.
- Built- in cross connection.
- LED indication for signal status at cable landing.

Refer to Table 5-47, Table 5-53, Table 5-54 and Table 5-57.

The Object Oriented Connection Units DSTD 145, DSTD 147, and DSTD 148 may be used in one of two separate possible ways:

1. **Four digital inputs per object:** Connect Digital Input Board DSDI 110A/DSDI 110AV1 into connectors X81, X83, X85, and X87 on each Object Oriented Connection Unit according to Figure 5-107.
2. **Two digital inputs per object:** Connect Digital Input Board DSDI 110A/DSDI 110AV1 into connectors X82, and X86 on each Object Oriented Connection Unit according to Figure 5-108.

Digital output board DSDO 110/ DSDO 115/ DSDO 115A always connects to X84 on each connection unit according to Figure 5-109.

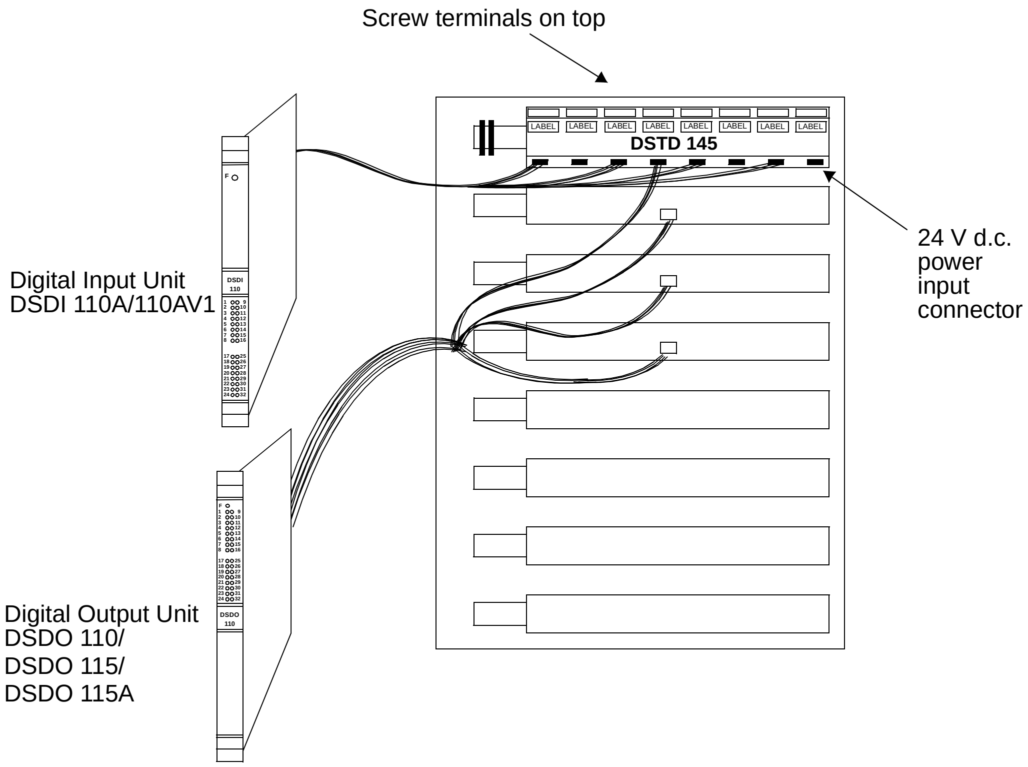

Screw terminals on top
LABEL
LABEL
LABEL
LABEL
LABEL
LABEL
LABEL
LABEL
DSTD 145
24 V d.c. power input connector
Digital Input Unit DSDI 110A/110AV1
F
DSDI 110
Digital Output Unit DSDO 110/ DSDO 115/ DSDO 115A
F
DSDO 110

Figure 5-106. Connection to DSTD 145/ 147/ 148

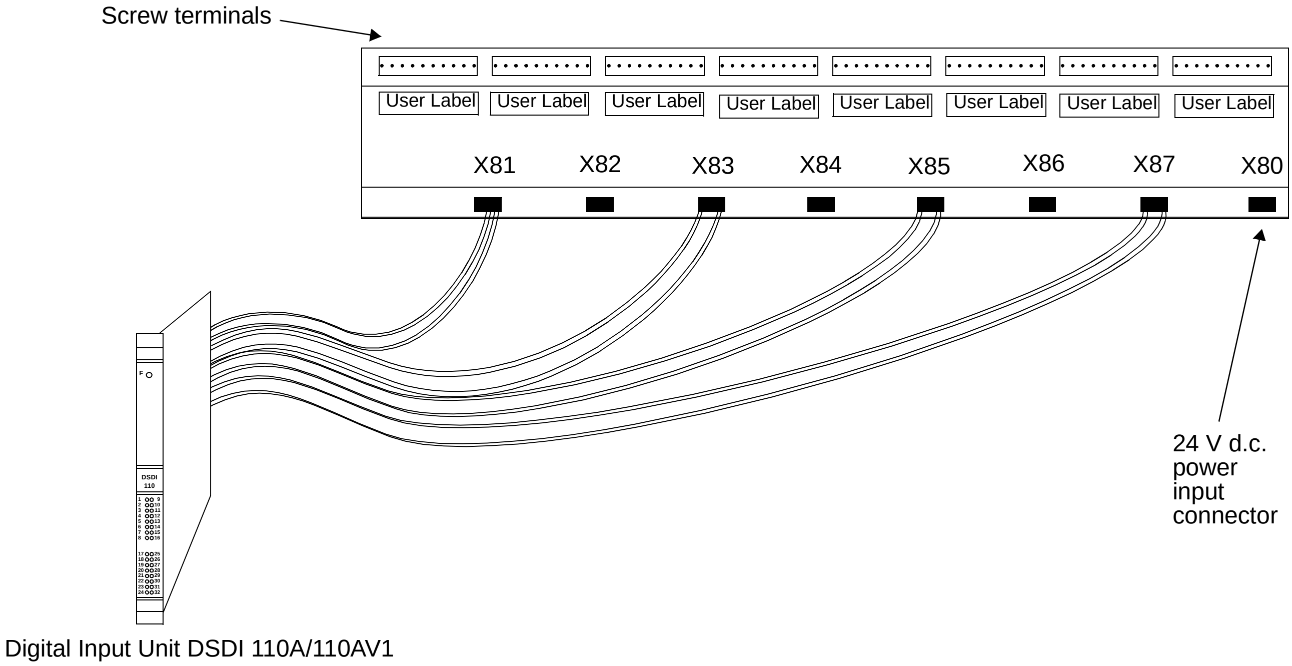


Figure 5-107. 4 DI per Plug- in Connector

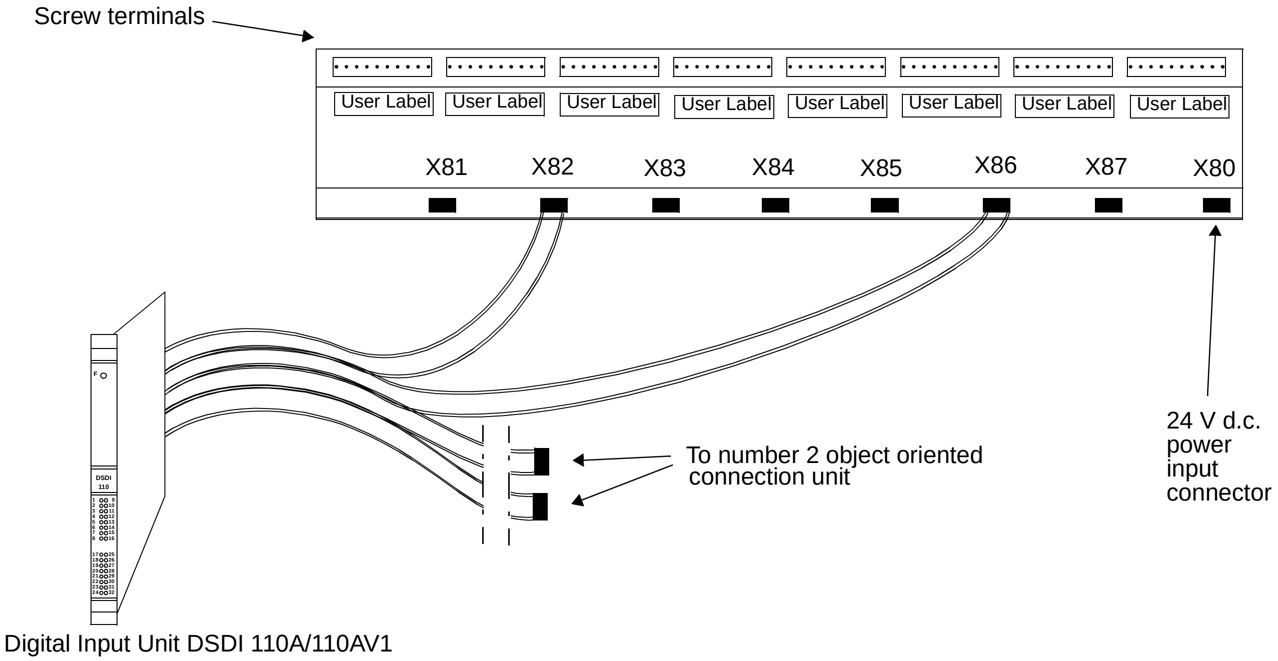


Figure 5-108. 2 DI per Plug- in Connector

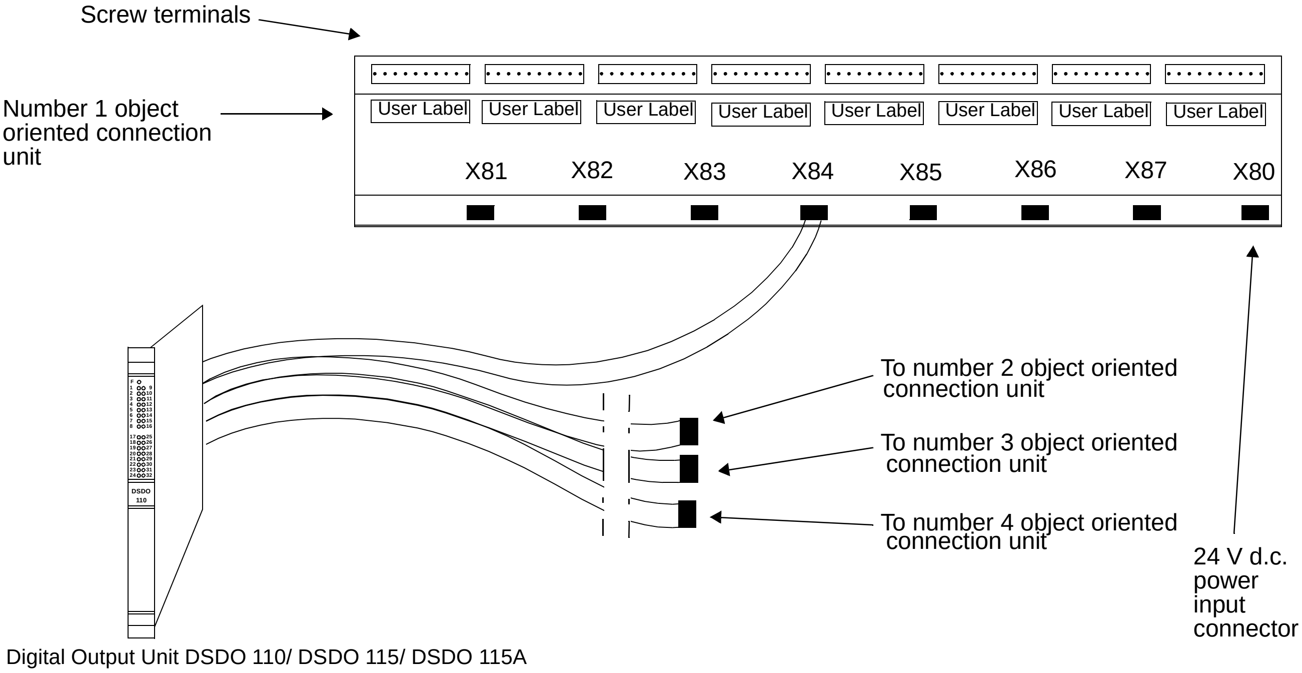

Screw terminals
Number 1 object oriented connection unit
User Label
User Label
User Label
User Label
User Label
User Label
User Label
User Label
X81
X82
X83
X84
X85
X86
X87
X80
To number 2 object oriented connection unit
To number 3 object oriented connection unit
To number 4 object oriented connection unit
24 V d.c. power input connector
DSDO 110
Digital Output Unit DSDO 110/ DSDO 115/ DSDO 115A

Figure 5-109. 1 DO per Plug- in Connector (all Ribbon Cables are of the Same Length)

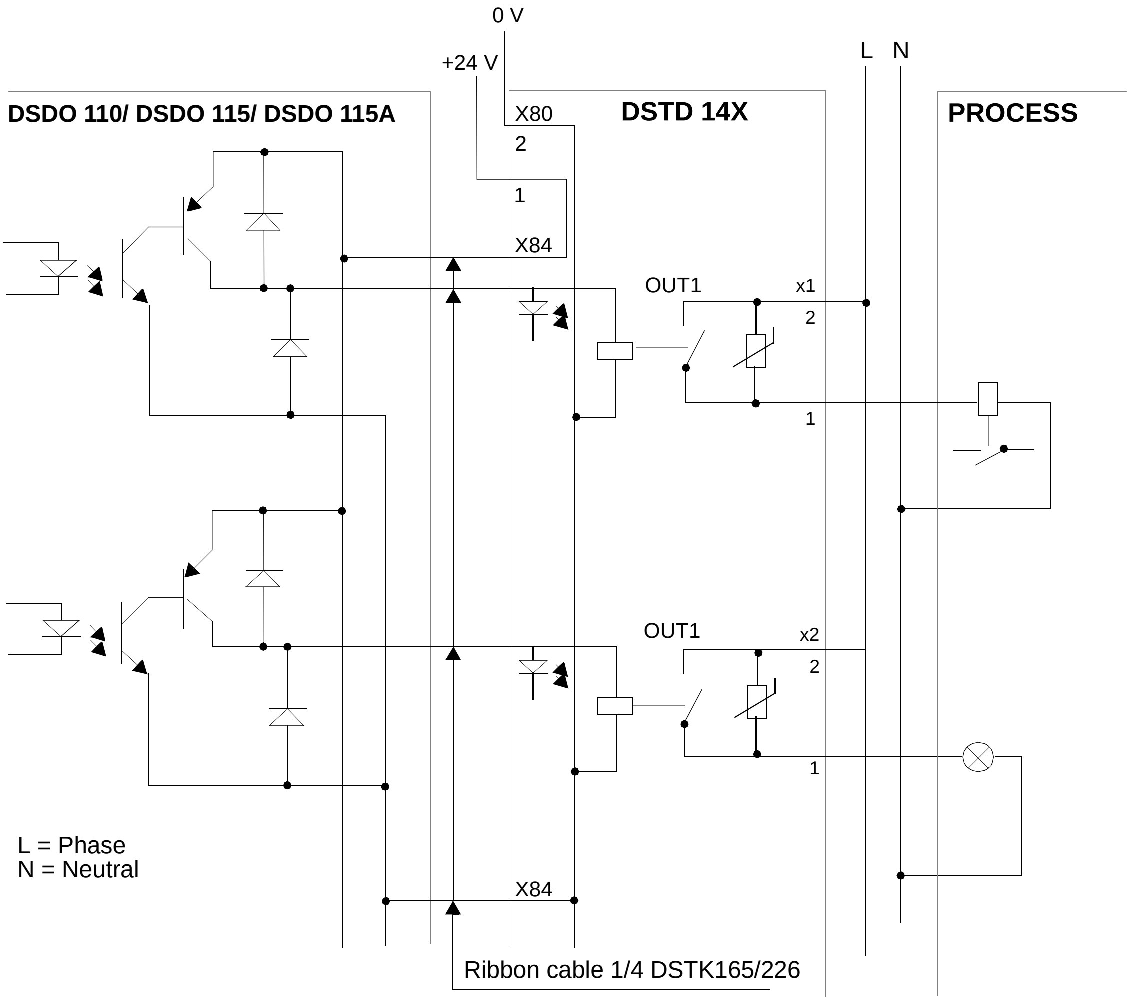


Figure 5-110. Example of Connection of DSDO 110/ DSDO 115/ DSDO 115A to DSTD 145/DSTD 147/DSTD 148

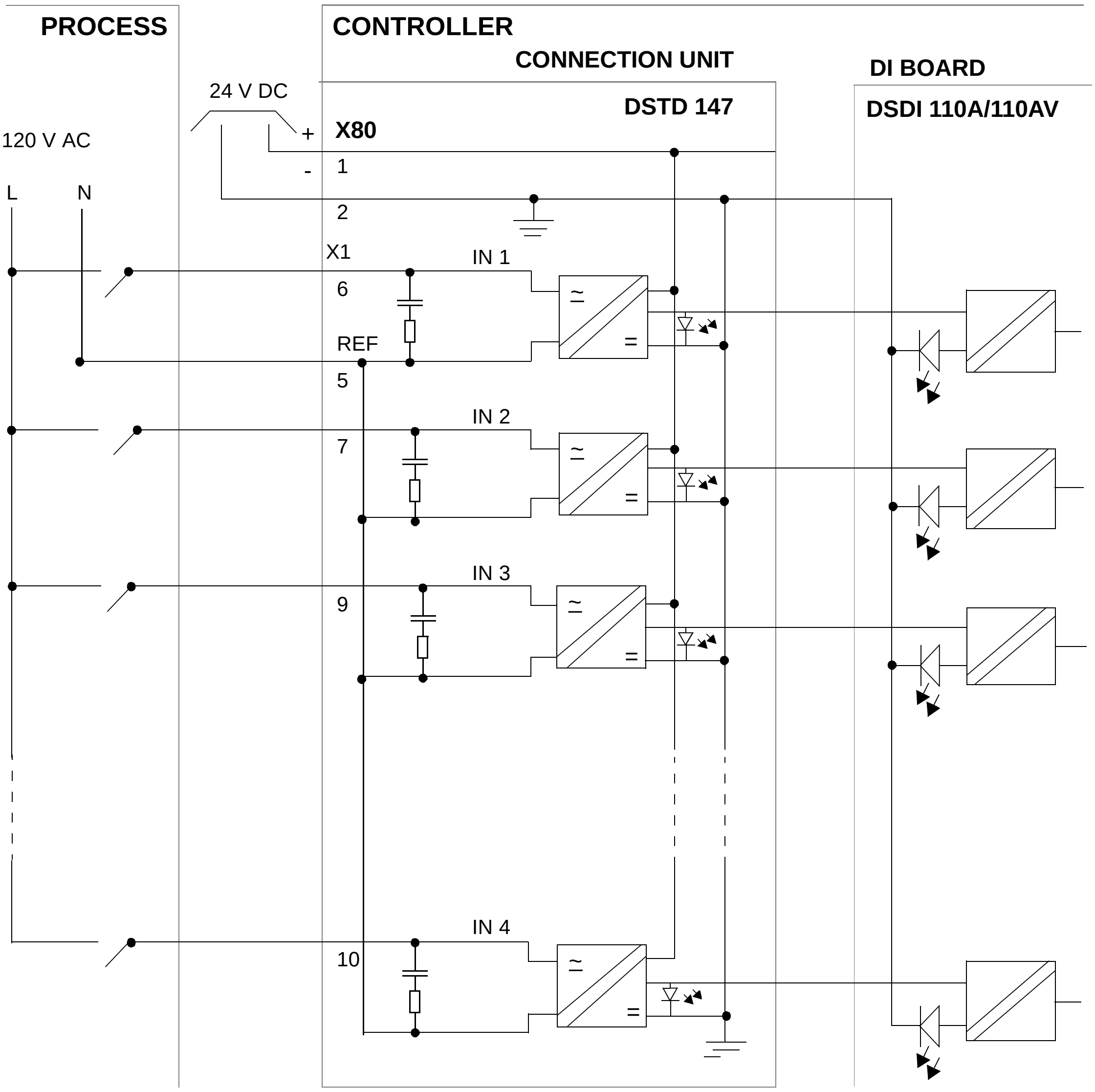


Figure 5-111. Example of Connection of DSDI 110A/DSDI 110AV1 to Connection Unit DSTD 147

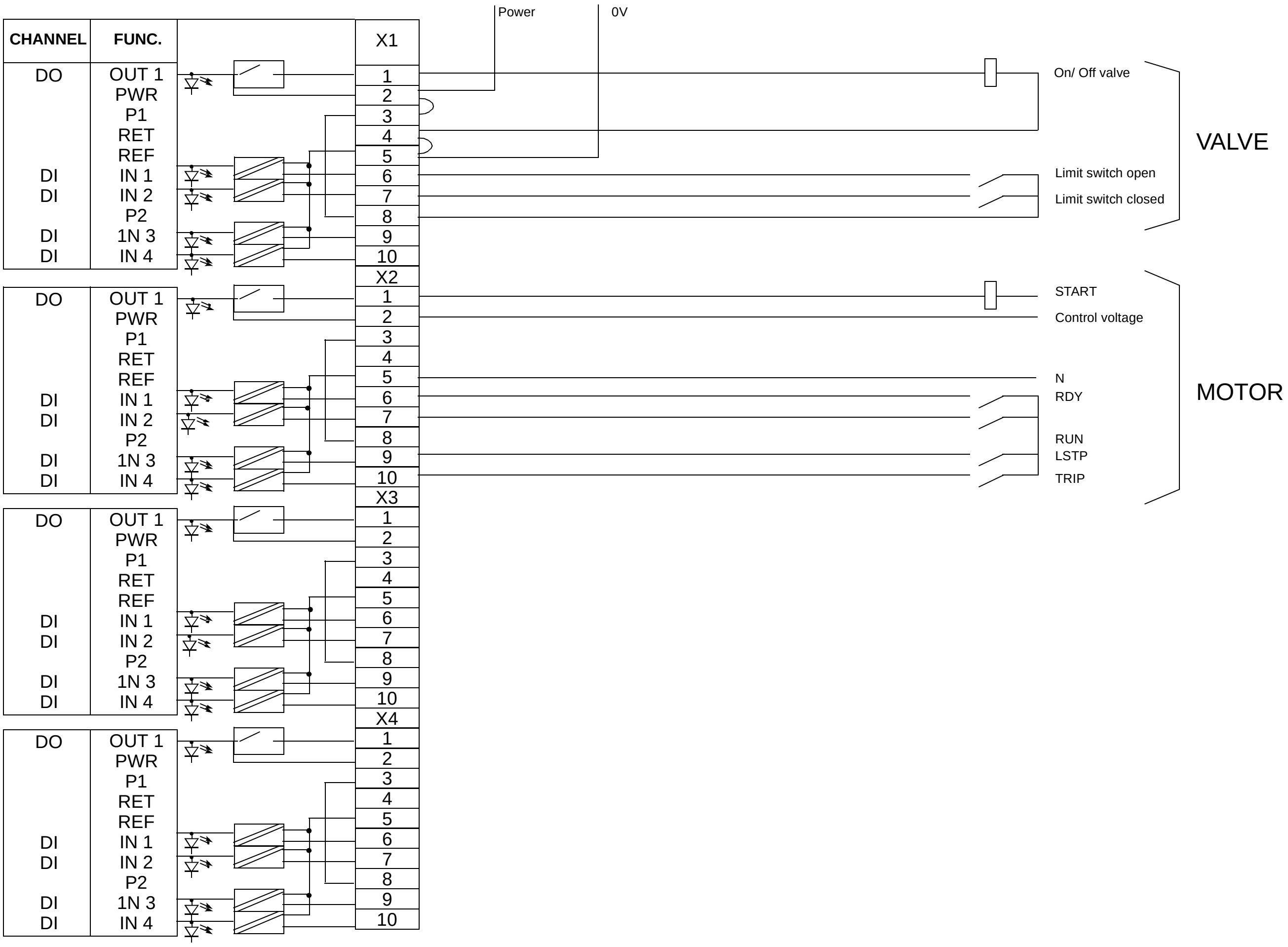
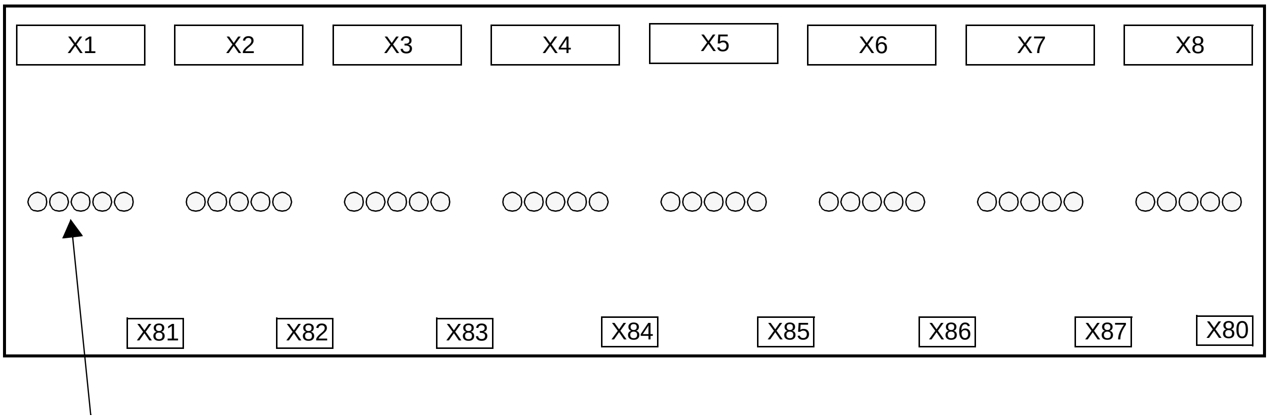


Figure 5-112. Example of Connection to the Process with Connection Unit DSTD 145/DSTD 147/DSTD 148

5.8.2 Jumpering and Connections

There are no jumpers on DSTD 145/ DSTD 147/DSTD 148.

The connectors on the object oriented connection units are according to Figure 5-57.



5 yellow LEDs indicates the activity on the corresponding connection on each of the 8 objects.

Figure 5-113. Connectors on DSTD 145/DSTD 147/DSTD 148

5.9 Pulse Counter Boards (DSDP 110, 140A, 150 and 170)

There are four different types of pulse counter boards: DSDP 110, DSDP 140A, DSDP 150 and DSDP 170.

Use DSDP 110 to connect pulse signals with amplitudes 24 V and maximum frequency 40 Hz.

Use DSDP 140A to position systems.

Use DSDP 150 for pulses with amplitudes 5/12/24 V and maximum frequency 10 kHz.

Use DSDP 170 for pulses with amplitudes 5/12/24 V ±13 mA or signals from RS-485 Line-drivers. The maximum input pulse frequency 2.5 MHz.

The inputs are galvanically isolated from the ground potential of the computer system with opto-couplers. Key data for the pulse counter boards are given in the table below.

Table 5-58. Pulse Counter Boards, Key Data

Data	DSDP 110	DSDP 140A	DSDP 150	DSDP 170
Number of channels	32 4 x (7 + 1 direction signal)	3 pulse inputs 1 analog output 4 digital outputs 2 digital inputs	12 inputs (12 outputs, might not be supported in the Controller software.)	4 x: 2 pulse inputs 1 strobe in 1 digital in 1 digital out
Nominal voltage	Pulse input: 24V nom. (15 - 30V) Max 40 Hz RI = 3,5 kΩ	Pulse input: ±13 mA max 80 kHz Ri = 200 Ω DI: 24 V d.c. DO: 24 V d.c. (max 150 mA)	Pulse input: 5/12/24 V max 10 kHz Ri= 5,6 kΩ	Pulse input: 5/12/24 V /±13 mA max 2.5 MHz DI: 24 V d.c. DO: 24 V (max 250 mA)
Current Consumption +5V	460 mA	1,1 A	1,0 A	600 mA
+24V internal	-	150 mA	-	-
+24V external	150 mA	300 mA	200 mA	750 mA
Galvanic isolation	Opto-coupler	Opto-coupler	Opto-coupler	Opto-coupler
Connection unit	DSTD 150A or DSTD 190	DSTD 150A or DSTD 190	DSTD 150A or DSTD 190	DSTX 170
Cable to DSTD	DSTK 150	DSTK 160	DSTK 160	DSTK 199
Cable area (screw terminals on the connection unit)	0.5 - 2.5 mm^2			

5.9.1 DSDP 110

Use DSDP 110 for pulse counting with a maximum frequency of 40 Hz, 1 ms filter time and with a pulse pause relation between 1:3 and 1:1.

There is a programmable low-pass filter for each channel on the circuit board.

The filtered pulses control a reversible eight bits buffer counter on the board.

A separate channel, common to each group, controls the direction of the counting up or down as required (see Figure 5-114 below).

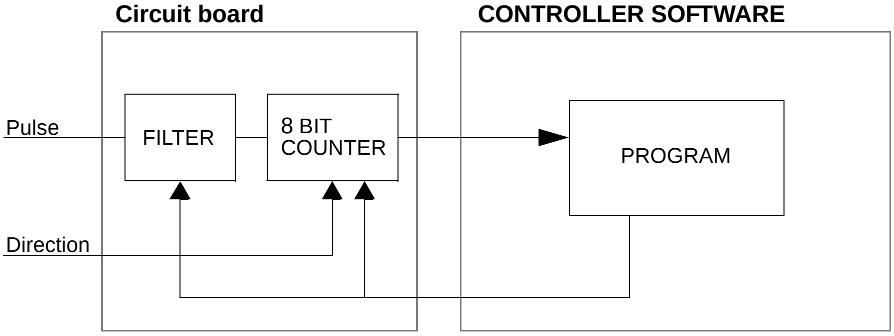


Figure 5-114. Signal Processing for Pulse Counter Board DSDP 110

5.9.1.1 Front Panel

The front panel of pulse counter board DSDP 110 is shown in Figure 5-115 below.

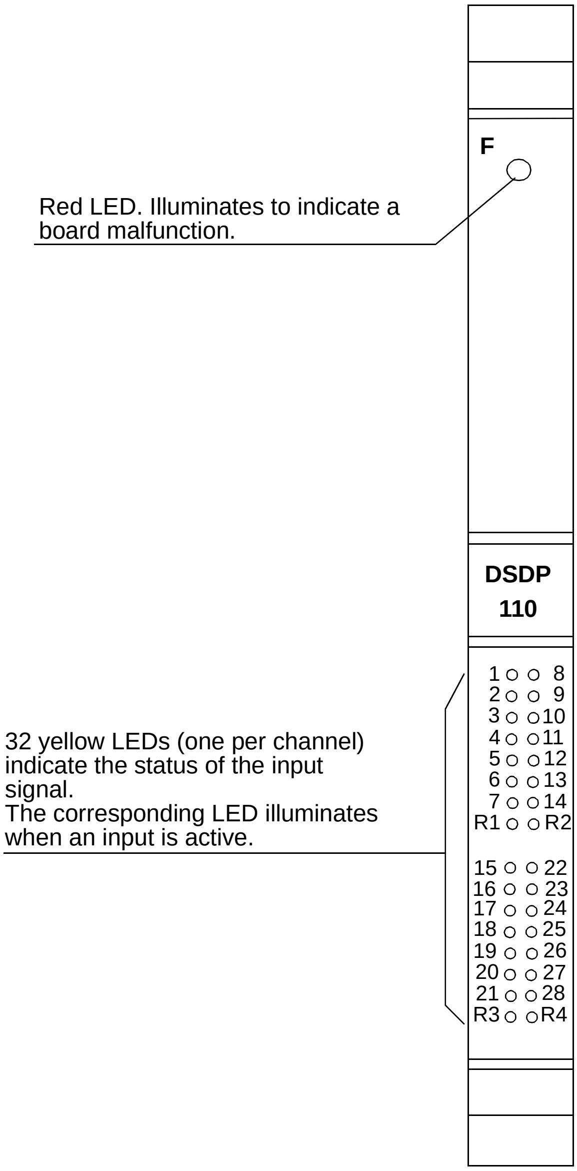

F
Red LED. Illuminates to indicate a board malfunction.
DSDP
110
1 8
2 9
3 10
4 11
5 12
6 13
7 14
R1 R2
15 22
16 23
17 24
18 25
19 26
20 27
21 28
R3 R4
32 yellow LEDs (one per channel) indicate the status of the input signal.
The corresponding LED illuminates when an input is active.

Figure 5-115. Front Panel of DSDP 110

5.9.1.2 Jumpering of DSDP 110

The pulse counter board DSDP 110 has only one switch group, S1, for address setting.

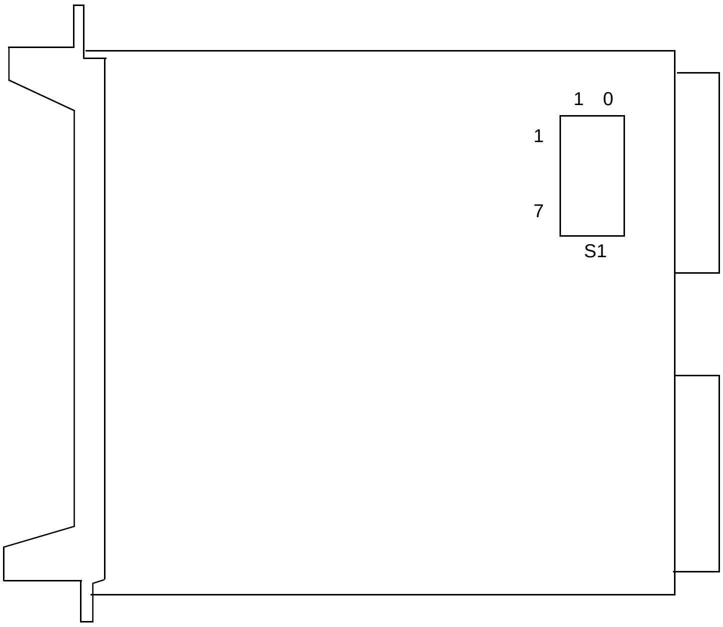


Figure 5-116. Pulse Counter Board DSDP 110, Location of Switch Group

The address range for the pulse counter board is H’60 - H’8F (H’ = hexadecimal notation), which corresponds to the range 96 - 143 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

5.9.1.3 Jumpering of Connection Units for DSDP 110

There are no jumpers on the connection units DSTD 150A or DSTD 190. DSTD 150A is shown in Figure 5-81, and DSTD 190 is shown in Figure 5-81.

5.9.1.4 Connection of DSDP 110 to the Process

Figure 5-117 shows an example of the connection of the pulse counter board DSDP 110 to the process. The direction signals are designated R1, R2 or DIR (direction).

Use the connection unit DSTD 150A or DSTD 190, which have been described in connection with digital input boards, to connect the pulse counter board to the process (see Table 5-53 Figure 5-81 and Figure 5-81). The pulse counter board and the connection unit are connected by DSTK 150.

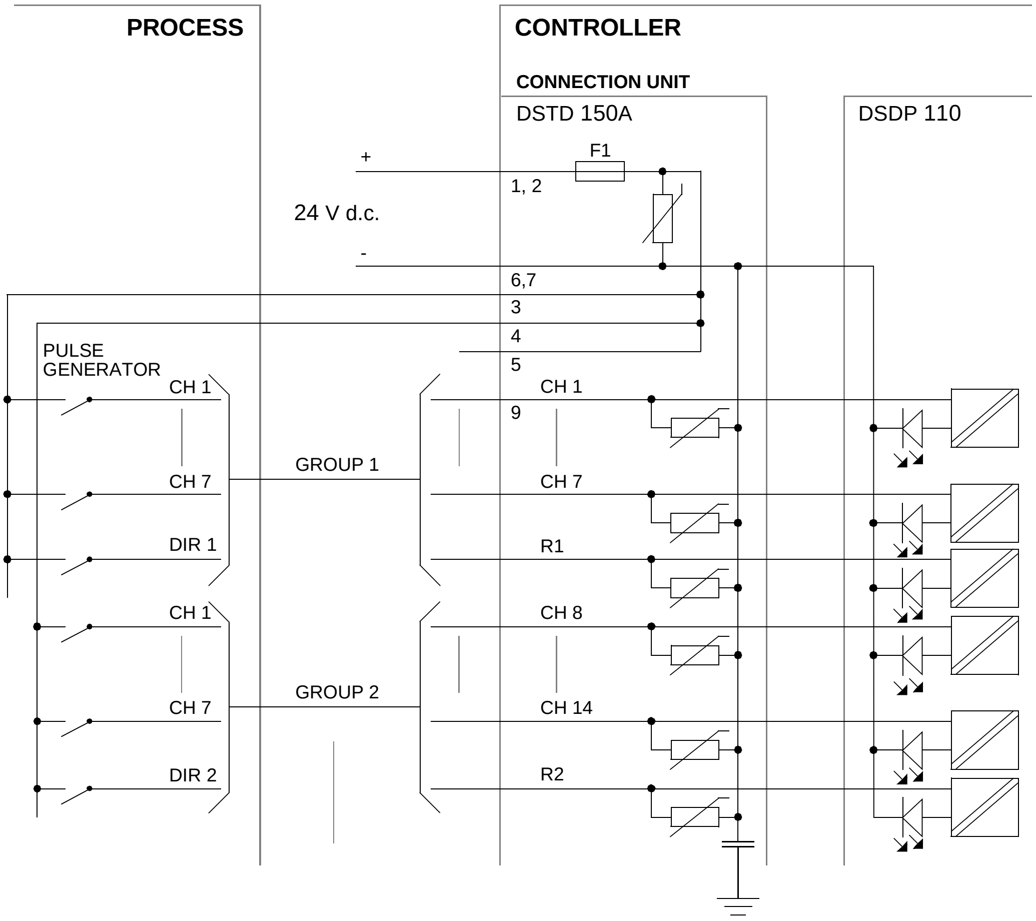


Figure 5-117. Example of Connection of DSDP 110

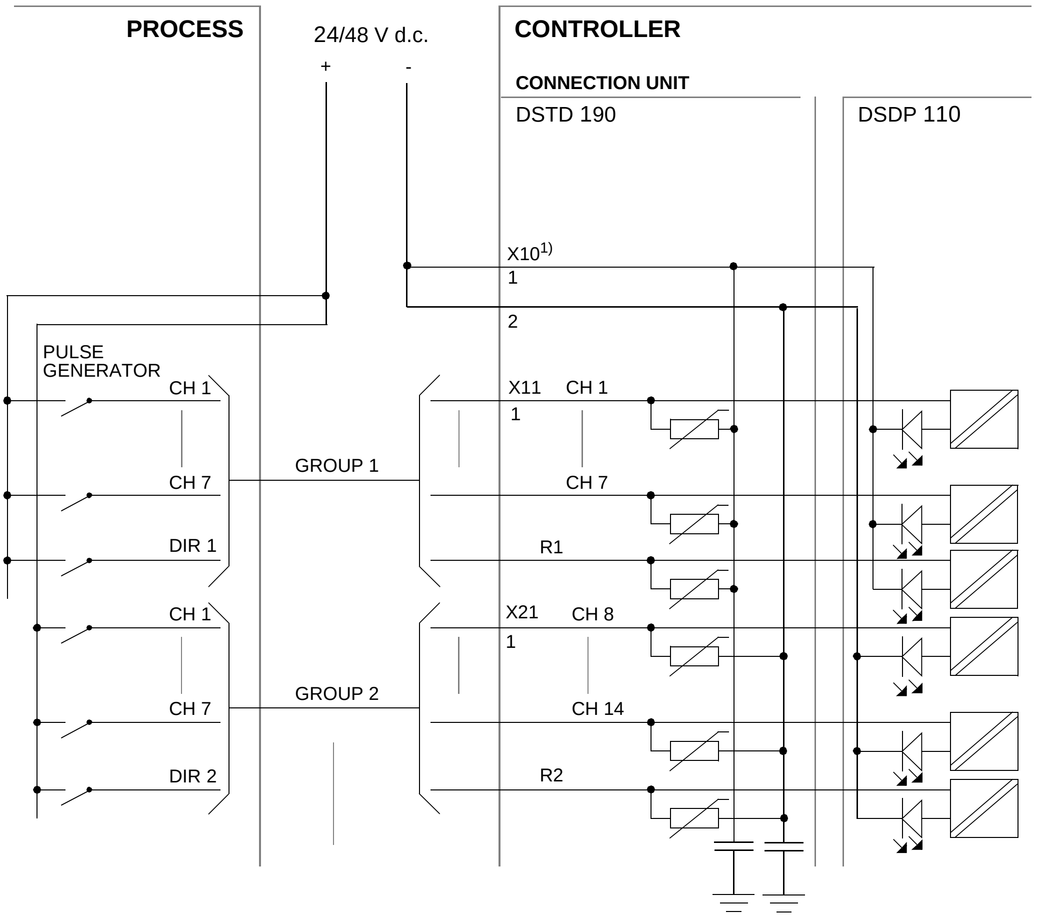


Figure 5-118. Example of Connection of DSDP 110

1) A connecting bar is delivered with the unit and it can be used to connect the four groups in X10 to the same transducer power supply return.

5.9.2 DSDP 140A

DSDP 140A is a pulse counter board which, with its embedded software, is a complete positioning system. The positioning application is described in detail in *Positioning System, User's Manual, 7650 069-201.*

5.9.2.1 Front Panel

The front panel of the pulse counter board DSDP 140A is shown in Figure 5-119 below.

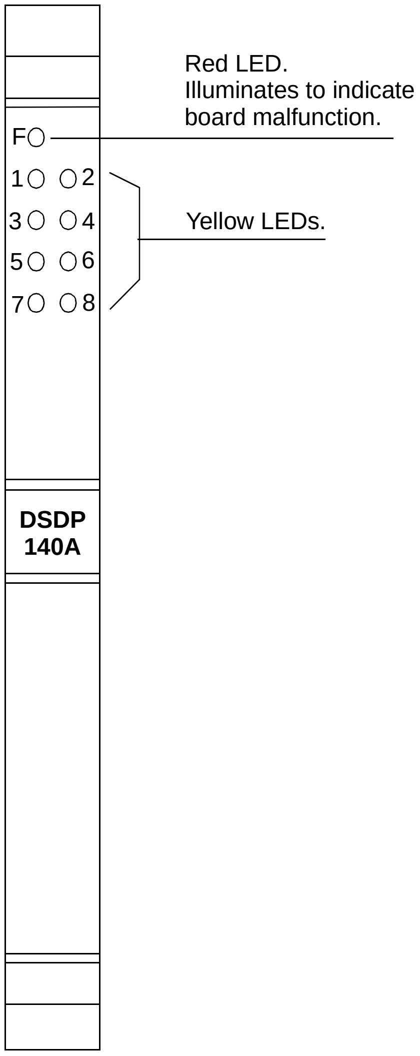


Figure 5-119. Front Panel of DSDP 140A

5.9.2.2 Jumpering of DSDP 140A

DSDP 140A is jumpered for different functions, as shown in Table 5-59 below. The jumper groups are located on DSDP 140A, as shown in Figure 5-120.

Table 5-59. Jumpering of DSDP 140A

Switch Function	Switch Groups
Address	S1
Filter time	S2
Mode selection	S3, S4

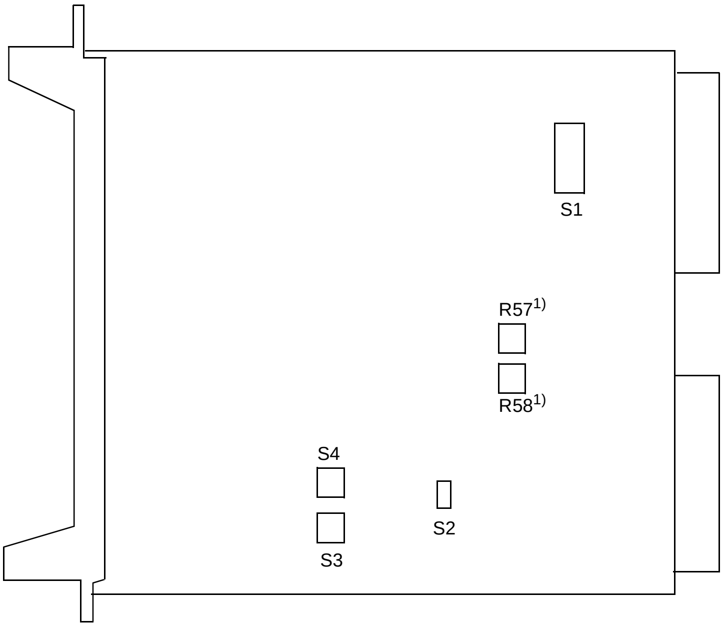


Figure 5-120. Pulse Counter Board DSDP 140A, Location of Switch Groups

1) R57 and R58 are used for adjustment of the analog output.

5.9.2.3 Address Jumpering

The address range for pulse counter and frequency measurement board DSDP 140A is H’C0 - H’EF (H’ = hexadecimal notation), which corresponds to the range 192 - 239 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

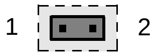
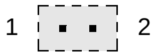
NOTE

DSDP 140A occupies two addresses. An even address is selected via S1, but the board occupies the following odd address as well.

5.9.2.4 Filter Time Jumpering

The filter time for the digital input DI1 can be 1 ms or 12 ms. The time is selected according to Table 5-60 below.

Table 5-60. Selection of Filter Time, Switch Group S2

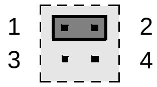
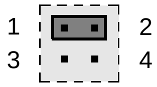
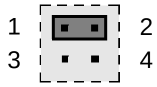
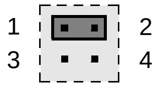
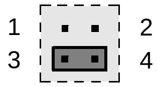
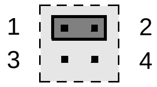
Filter Time	S2 Jumpering
1 ms	
12 ms	

The filter time for the other digital input, DI2, is 1 ms.

5.9.2.5 Function Mode Jumpering

Use the switch groups S3 and S4 to select different function modes, as shown in Table 5-61 below.

Table 5-61. Jumpering of Function Mode

Function Mode	S3 Jumpering	S4 Jumpering
Analog positioning		
Positioning with discrete speed		
Positioning measurement		

5.9.2.6 Connection of DSDP 140A to the Process

Figure 5-121 below shows an example of the connection of the pulse counter board DSDP 140A to the process.

Use the connection unit DSTD 150A or DSTD 190, which have been described in connection with digital input boards, to connect the pulse counter board to the process (also see Table 5-53). The pulse counter board and the connection unit are connected by DSTK 160. See Figure 5-121 below.

NOTE

The four opto-isolated digital outputs have a common ground and are not short-circuit protected.
The analog output ground must be connected to ground at the load.

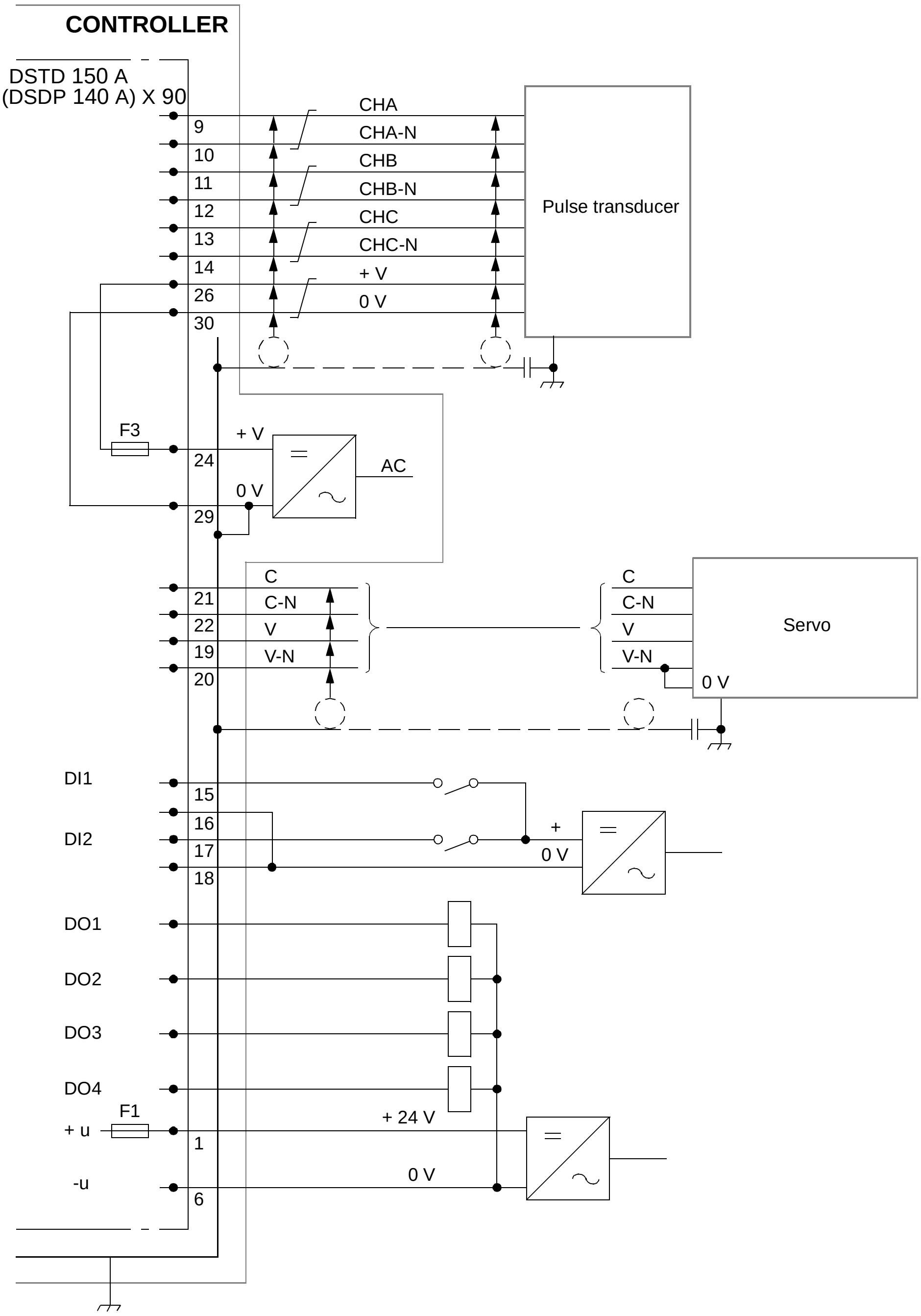


Figure 5-121. Example of Connection of DSDP 140A

The three opto-isolated inputs for pulse transducers are called CHA, CHB and CHC.

5.9.3 DSDP 150

DSDP 150 is a pulse counter board for fast pulse counting and frequency measurement based on pulse trains up to 10 kHz. Use the board DSDP 150 to connect pulse signals with a nominal amplitude of 5/12 or 24 V. The board contains 12 inputs in two groups, galvanically isolated with opto-couplers.

You can select four function modes with the jumpers on DSDP 150 and the controller software:

3. Pulse counting
4. Frequency measurement 1. Period time measuring: One period is measured and the resolution is ≤ 0,2% at F ≤ 1000 Hz.
5. Frequency measurement 2. This type of measuring requires two channels per measurement object. F ≤ 10 kHz.
6. Pulse relation measurement.

Figure 5-122 below shows the signal processing on DSDP 150.

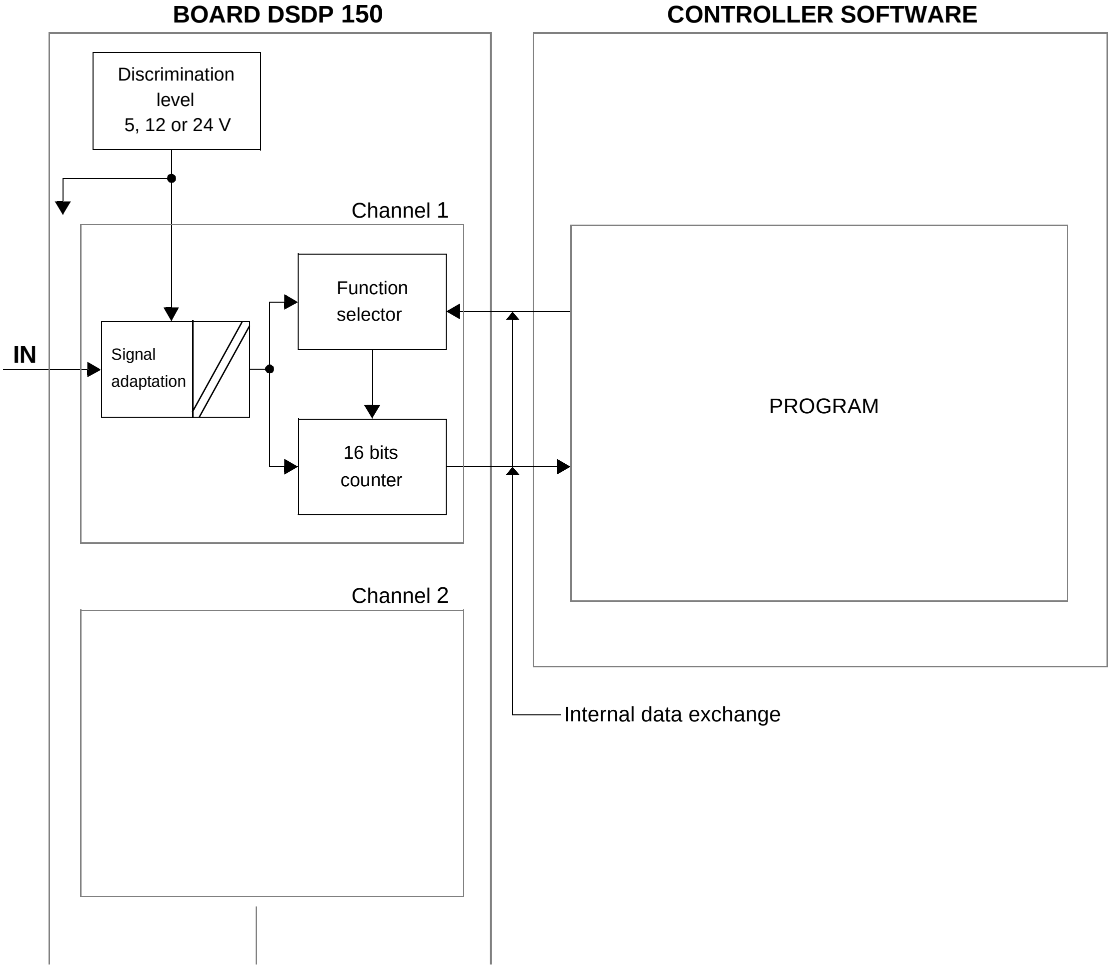


Figure 5-122. Signal Processing on DSDP 150

5.9.3.1 Front Panel

The front panel of the pulse counter and frequency measurement board DSDP 150 is shown in Figure 5-123 below.

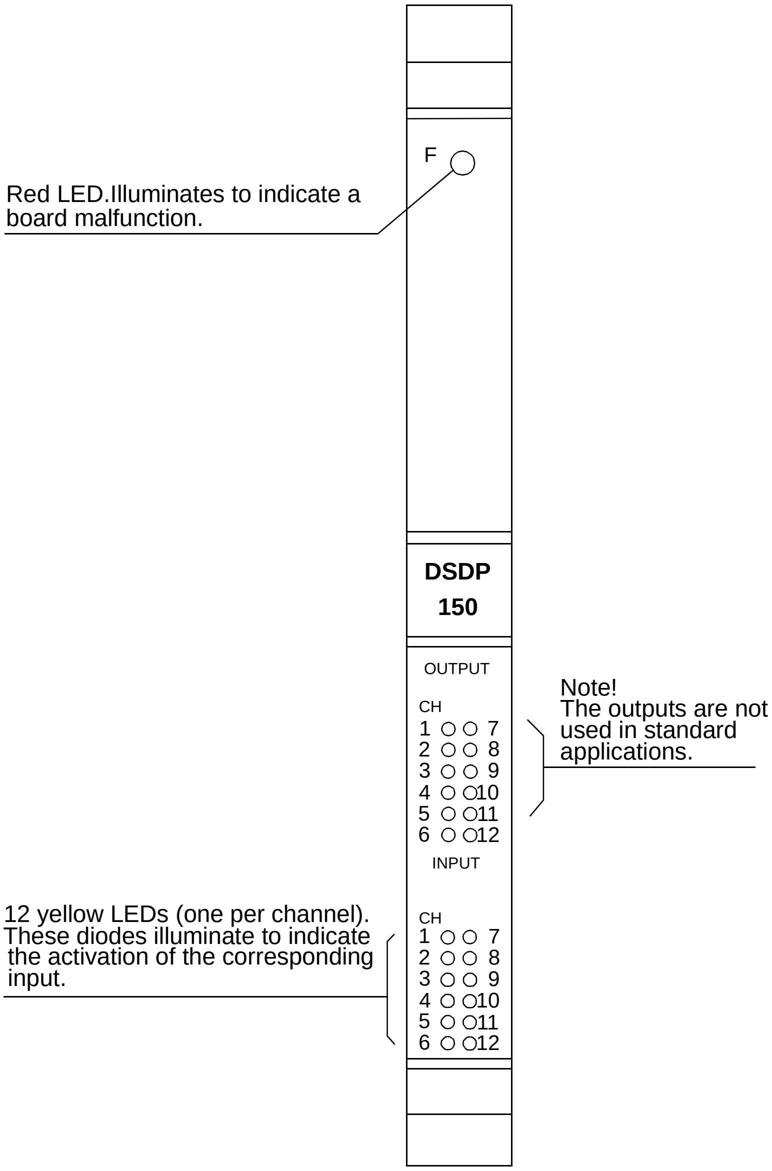

F
Red LED.Illuminates to indicate a board malfunction.
DSDP 150
OUTPUT
CH
1 ○ ○ 7
2 ○ ○ 8
3 ○ ○ 9
4 ○ ○ 10
5 ○ ○ 11
6 ○ ○ 12
Note! The outputs are not used in standard applications.
INPUT
CH
1 ○ ○ 7
2 ○ ○ 8
3 ○ ○ 9
4 ○ ○ 10
5 ○ ○ 11
6 ○ ○ 12
12 yellow LEDs (one per channel). These diodes illuminate to indicate the activation of the corresponding input.

Figure 5-123. Front Panel of DSDP 150

5.9.3.2 Jumpering of DSDP 150

DSDP 150 is jumpered for different functions, as shown in Table 5-62 below.

Table 5-62. Jumpering of DSDP 150

Switch Function	Switch Groups
Address	S1
Function mode	S101 - S112
Voltage level	S10, S20
Production test	X3

The switch groups are located on DSDP 150, as shown in Figure 5-124 below.

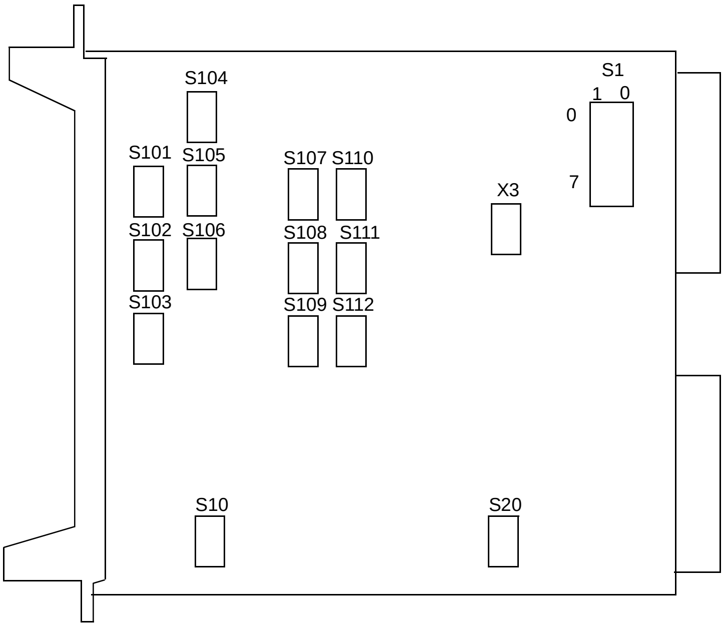


Figure 5-124. Pulse Counter Board DSDP 150, Location of Switch Groups

Address Switch

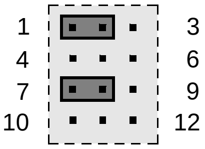
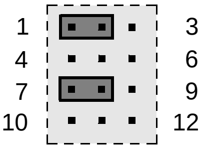
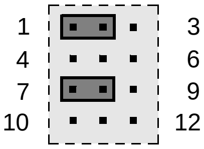
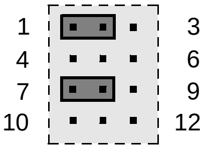
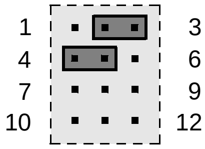
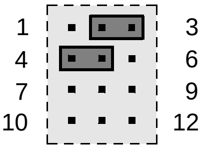
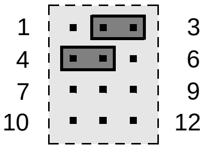
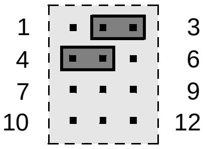
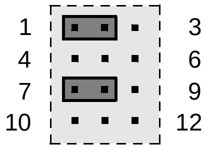
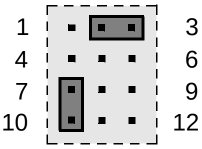
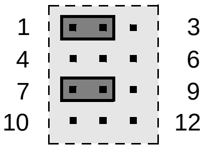
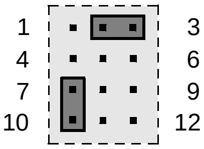
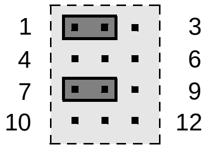
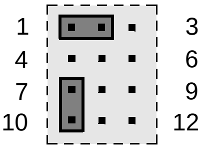
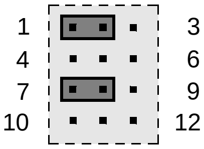
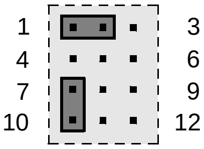
The address range for pulse counter and frequency measurement board DSDP 150 is H’C0 - H’EF (H’ = hexadecimal notation), which corresponds to the range 192 - 239 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

Function Mode Jumpering

The board DSDP 150 is jumpered for different function modes, as shown in Table 5-63 below.

Table 5-63. Jumpering for Function Mode Selection on DSDP 150

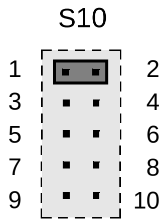
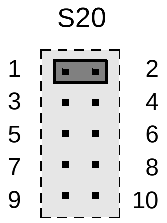
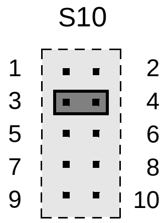
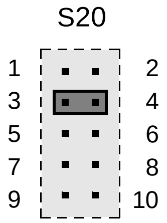
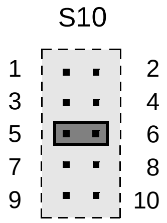
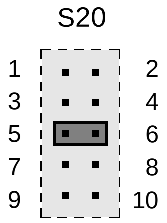
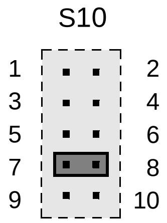
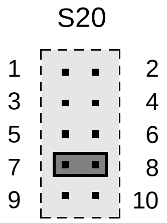
Function mode	Channel 1	Channel 2	...	Channel 11	Channel 12
Pulse counting	S101 	S102 	...	S111 	S112 
Frequency measurement 1 (during one period)	S101 	S102 	...	S111 	S112 
Frequency[1)] measurement 2 (during several periods)	S101 	S102 	...	S111 	S112 
Pulse relation[1)] measurement	S101 	S102 	...	S111 	S112 

1) The channels are jumpered in pairs for these functions.

Voltage Level Jumpering

The voltage level of the input signal is jumpered with switch group S10 for channels 1-6 and with switch group S20 for channels 7-12, as shown in Table 5-64 below.

Table 5-64. Jumpering of Voltage Level on DSDP 150

Voltage level (pulse amplitude) *	**Channels 1 - 6**	**Channel 7 - 12**
5 - 24 V (controlled by the supply voltage to the transducer - U_g Connected to the UG-inputs)		
24 V nom. 15 - 30 V DC-level ≤+6V		
12 V nom. 8 - 16 V DC-level ≤+3V		
5 V nom. 4 - 8 V DC-level ≤+1V		

* The zero reference for the pulse amplitude and DC-level is the U- from the 24V-power supply see Figure 5-126 (Terminal 29,30).

Production Test Switch

The switch group X3 is used for production tests only. It shall always be set according to Figure 5-125 below.

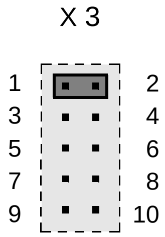


Figure 5-125. Jumpering of X3

5.9.3.3 Connection of DSDP 150 to the Process (DSTD 190)

The following figure, Figure 5-126, shows an example of the connection of the pulse counter board DSDP 150 to the process.

Use the connection unit DSTD 150A or DSTD 190, which have been described in connection with digital input boards, to connect the pulse counter board to the process (also see Table 5-53). The pulse counter board and the connection unit are connected by DSTK 160. The transducers are connected via screened cable to the connection unit.

The zero reference for the input signals, input amplitude and DC-level (see Table 5-64) is the 0 V (U- at terminal 29, 30 Figure 5-126) from the 24 V power Supply.

The input signals may also be an alternating (bipolar) signal with U- as zero reference as and the amplitude values given in Table 5-64.

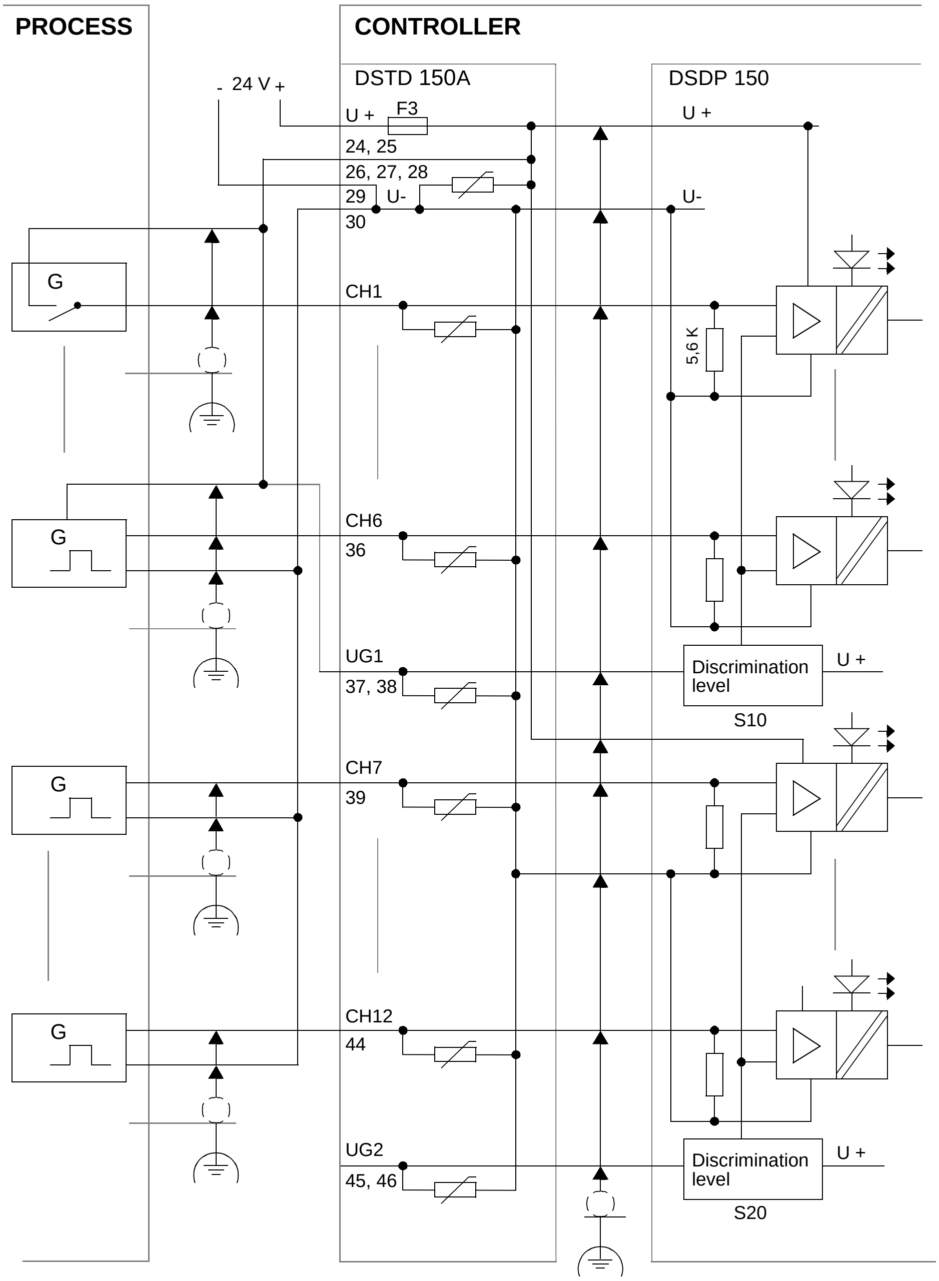


Figure 5-126. Example of Connection of DSDP 150

5.9.4 DSDP 170

DSDP 170 is an advanced quad-channel pulse counting board for incremental pulse transmitters.

Each channel contains counters and registers for position or length and speed or frequency measuring and a programmable clock generator for setting the measuring interval.

The counters can count up or down at a maximum pulse frequency of 2.5 MHz.
The direction of counting is determined by a quadrature decoder or by defined pulse inputs for up-and-down counting.

Each measuring channel is equipped with:

- Pulse inputs

  Balanced inputs for 5, 12, 24 V, 13 mA or RS 485 Line-drivers. All channels are individually isolated.
  The inputs are matched to the desired signal level with solder jumpers on the connection unit. The input impedance for 5 V/13 mA is 200 Ω, for 12V 680Ω and 24 V 1.1 kΩ.
  The pulse inputs consist of:

  - Two individual, opto-isolated pulse inputs for 90° phase-shifted signals for direction sensing or separate pulse signals for up-and-down counting. These inputs are later referred to as channel A (CHA) and channel B (CHB).
  - One individual, opto-isolated pulse input for strobe (revolution) pulses from incremental pulse transmitters. Used for synchronization of the position counter.
    This input is later referred to as channel C (CHC).

- Digital input

  An individual, opto-isolated pulse input for synchronizing of the position counter.
  The voltage level is +24 V. This input is later referred to as DI.

- Digital output

  An opto-isolated, short-circuit-proof digital pulse output from the coincidence comparator. This output can be used to control external objects. Programmable pulse length, 24 V d.c., 250 mA. This output is later referred to as DO.

The process signals are connected to the connection unit DSTX 170, which is connected to the DSDP 170 board with the screened pair twisted cable DSTK 199. The transducers are connected via screened cable to the connection unit DSTK 170. Power supply for the transducer and auxiliary power supply for the digital input and the digital output are also applied to the connection unit. See Figure 5-127.

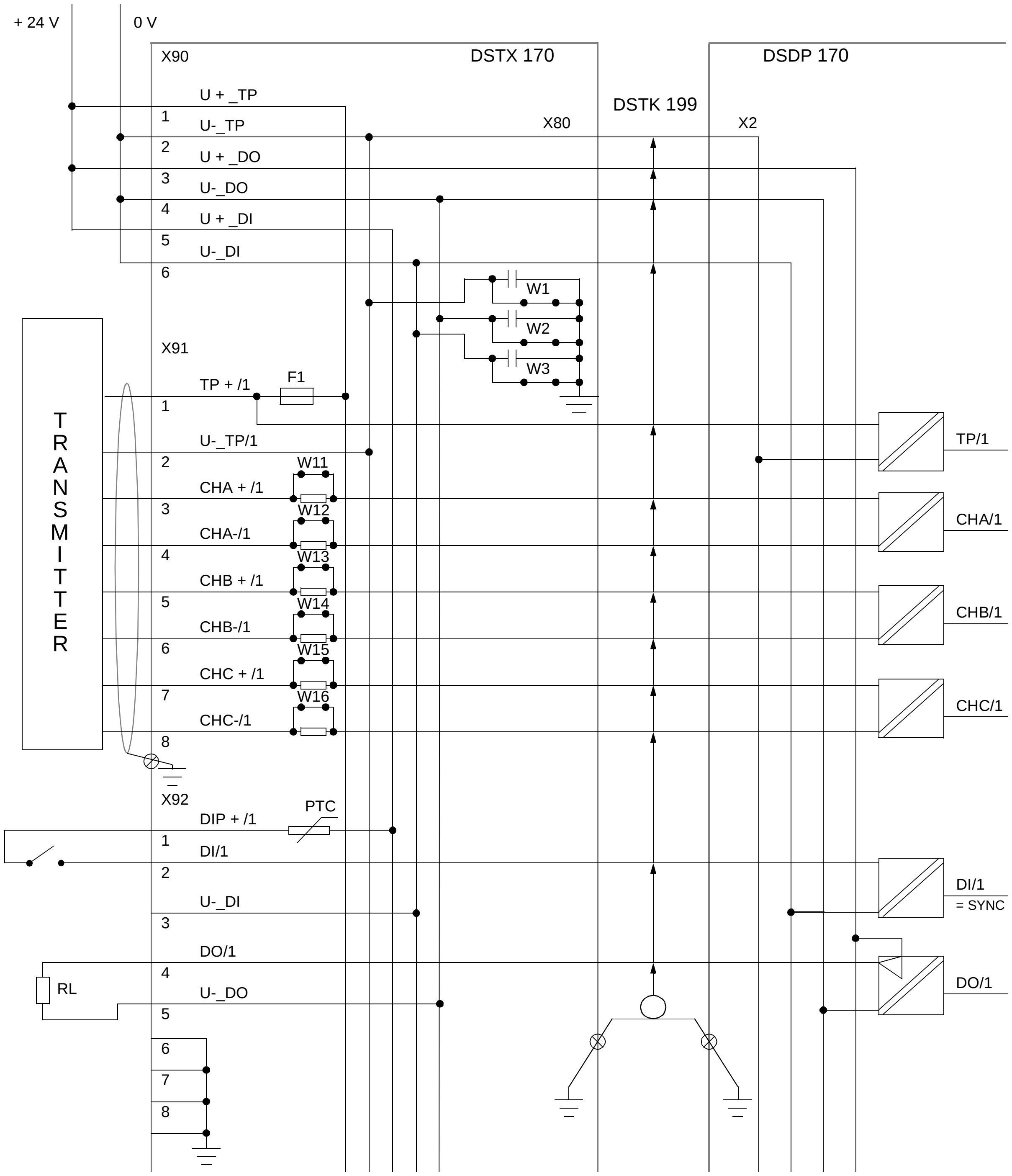


Figure 5-127. Example of Connection of DSDP 170

The connection unit DSTX 170 has set of terminals for each channel according to Table 5-65

Table 5-65. DSTX 170 Terminals

Signal	Terminal Connectors	Pin	Signal	Terminal Connectors	Pin
TP+	X91, X93, X95 and X97	1	DIP+	X92, X94, X96 and X98	1
U-_TP	- “ -	2	DI	- “ -	2
CHA+	- “ -	3	U-_DI	- “ -	3
CHA-	- “ -	4	DO	- “ -	4
CHB+	- “ -	5	U-_DO	- “ -	5
CHB-	- “ -	6	Ground	- “ -	6
CHC+	- “ -	7	Ground	- “ -	7
CHC-	- “ -	8	Ground	- “ -	8

The transducer supply, which is common to all four channels, and the auxiliary power supply for the digital input and the digital output, are connected to the X90 terminal on the connection unit, as shown in Table 5-66 below.

Table 5-66. Power Supply Connection

Power Supply	Terminal Connector	Pin
U+_TP	X90	1
U-_TP	X90	2
U+_DO	X90	3
U-_DO	X90	4
U+_DI	X90	5
U-_DI	X90	6

5.9.4.1 Front Panel

The front panel of the pulse counting and frequency measuring board DSDP 170 is shown in Figure 5-128 below. The indications are gathered in groups, one per channel. The abbreviations used, are explained in Figure 5-128.

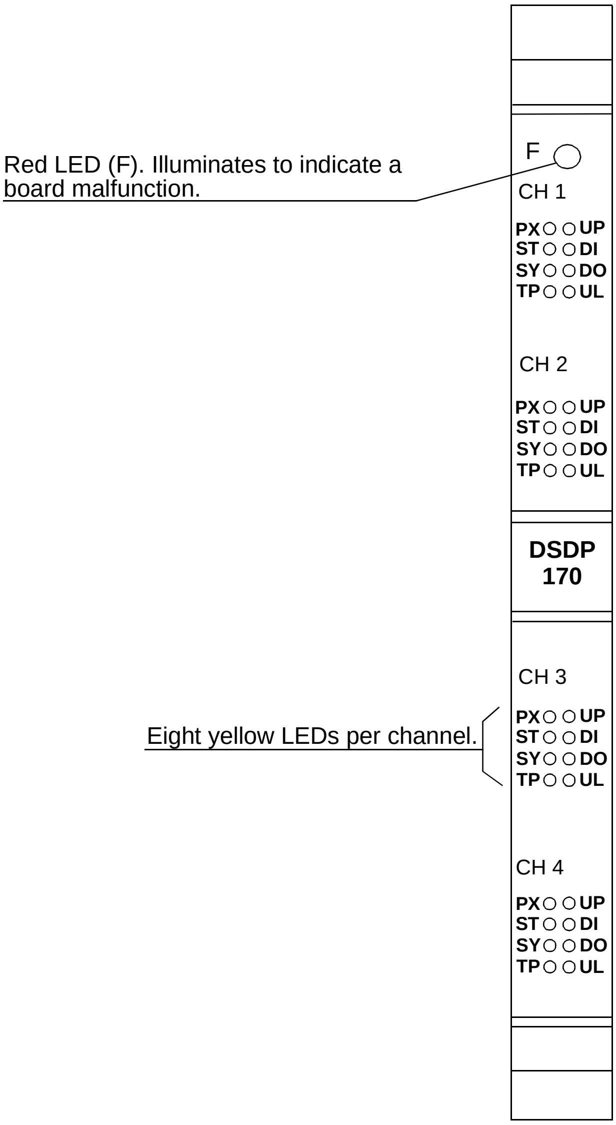


Figure 5-128. Front Panel of DSP 170

.The following abbreviations are used on the front panel of the DSDP 170:

PX	Flashes (min 0.2 s) for each PX pulse.
UP	Illuminates if the counter direction is up.
ST	Flashes (min 0.2 s) for each strobe pulse.
DI	Digital input.
SY	Illuminates when the counter is synchronized.
DO	Flashes (min 0.2 s) for each coincidence[1)] occurring.
TP	Transmitter power ok.
UL	Defined by user. Controlled by the controller software.

1) Coincidence = When the counter value has reached a value specified by the controller software.

5.9.4.2 Jumpering of DSDP 170

DSDP 170 is jumpered for different functions. Table 5-67 shows an overview of all jumpers on the board.

Table 5-67. Jumpering of DSDP 170

Switch Function	Switch Group
Address	S1
Interrupt level	S2
Measuring interval source	S9
Measuring interval time	S10
Filter time for inputs	S11 - S14

The location of the jumpers on the DSDP 170 is shown in Figure 5-129 below.

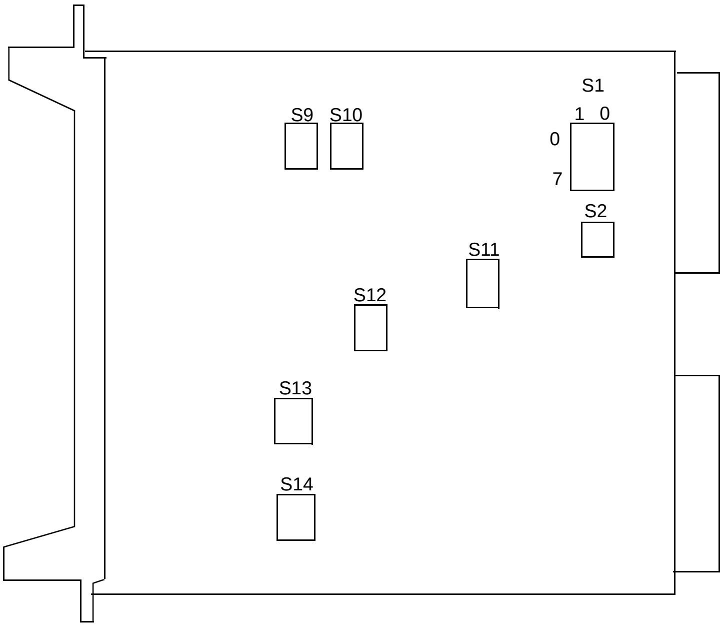


Figure 5-129. Pulse Counter Board DSDP 170, Location of Switch Groups

Address Switch

The address range for the board DSDP 170 is H’C0 - H’EF (H’ = hexadecimal notation), which corresponds to the range 192 - 239 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

Interrupt Level

Interrupts are not used in normal applications.

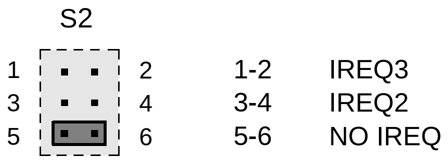


Figure 5-130. Jumpering of S2

Measuring Interval Source

Use the switch group S9 to set your choice of measuring interval source for speed or frequency measuring for each channel, as shown in Figure 5-131 below. The interval source can be either a programmable interval timer, PRIT, or the output from the coincidence comparator, COINC.

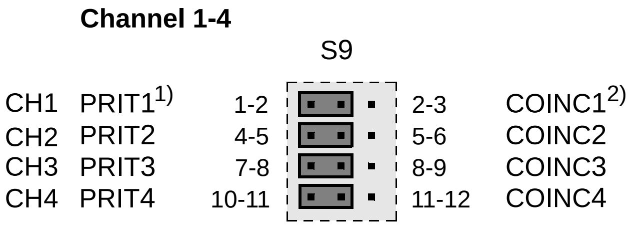


Figure 5-131. Normal Jumpering of S9

1) PRIT = Programmable interval time
2) COINC = Coincidence = When the counter value has reached a value specified by the controller software.

Measuring Interval Time

You can set the same measuring interval time for two or more channels on switch group S10, as shown below. The measuring interval time, MIT, is the output signal from the switch group S9.

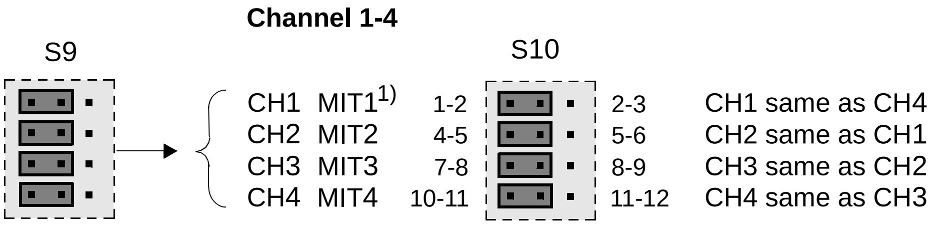


Figure 5-132. Normal Jumpering of S10

1) MIT = Measuring interval time selected on jumper S9

Filter Time for Inputs

The filter times for the four channels are set on switches S11 - S14, as shown in Figure 5-133 below.

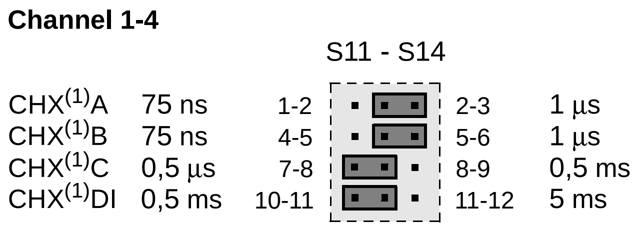

Channel 1-4
S11 - S14
CHX(1)A 75 ns 1-2 2-3 1 µs
CHX(1)B 75 ns 4-5 5-6 1 µs
CHX(1)C 0,5 µs 7-8 8-9 0,5 ms
CHX(1)DI 0,5 ms 10-11 11-12 5 ms

Figure 5-133. Jumpering of S11 - S14

1) X = Channel number

5.9.4.3 Jumpering of Connection Unit DSTX 170

Use solder jumpers on the connection unit to select the input signal level and how the grounding of external transducer supply is to be done. Figure 5-134 below shows the location of the solder jumpers on the connection unit DSTX 170.

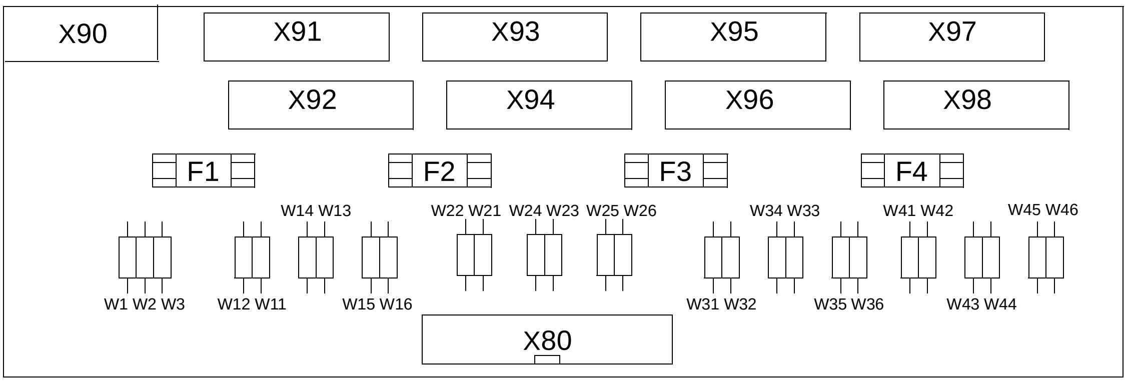


Figure 5-134. Connection Unit DSTX 170, Location of Solder Jumpers

Input Signal Level Jumper

Select high (+24 V), medium (12V) or low (+5 V/13 mA or RS 485) level pulse inputs for each channel on the connection unit DSTX 170 using solder jumpers (see Table 5-68 below). To select the high input level for a channel, cut the relevant solder jumper. The connection unit is delivered with **all solder jumpers in place**; that is, the default selection of every channel is low input level.

CAUTION

Wrong strapping on DSTX 170 may cause damage on the DSDP 170 inputs.

Table 5-68. Selection of Input Signal Level

Function		**CHA/1**		**CHB/1**		**CHC/1**		**...**	**CHB/4**		**CHC/4**	
		+	**-**	**+**	**-**	**+**	**-**	**...**	**+**	**-**	**+**	**-**
		W11	**W12**	**W13**	**W14**	**W15**	**W16**	**...**	**W43**	**W44**	**W45**	**W46**
Signal level for pulse inputs	High level +24 V (15.0 - 30 V)	OUT	OUT	OUT	OUT	OUT	OUT	...	OUT	OUT	OUT	OUT
	Medium 12V (7,5 - 15 V)	OUT	IN	OUT	IN	OUT	IN	...	OUT	IN	OUT	IN
	Low level 13 mA 5V (2.5 - 7.5 V) RS 485	IN	IN	IN	IN	IN	IN	...	IN	IN	IN	IN

Transducer Supply Grounding Jumper

Use solder jumpers to set the grounding of the transducer supply and the auxiliary supply on the connection unit DSTX 170 (see Table 5-69 below). To select capacitor grounding, cut the relevant solder jumper. The connection unit is delivered with all solder jumpers in place; that is, the default selection is direct grounding of the supply.

Table 5-69. Jumpering of Transducer Supply Grounding

Function		**U_TP**	**U_DO**	**U_DI**
		W1	**W2**	**W3**
Transducer supply and auxiliary supply for DI and DO	Direct grounding	IN	IN	IN
	Capacitor grounding	OUT	OUT	OUT

5.10 Application Specific Boards

5.10.1 Weighing Boards (DSXW 110 and 111)

Weighing boards enable you to connect strain gauge load cells to the control system. There are two different types of weighing boards: DSXW 110 for normal weighing applications and DSXW 111 (in combination with safety barriers) for weighing in areas classified as hazardous areas.

This section describes the weighing board hardware only. The weighing application is described in detail in *Weighing, User's Manual*. Information on topics such as calibration, connection of load cells, fault tracing, maintenance, operation and programming is available.

The block diagram for a weighing board is shown in Figure 5-135.

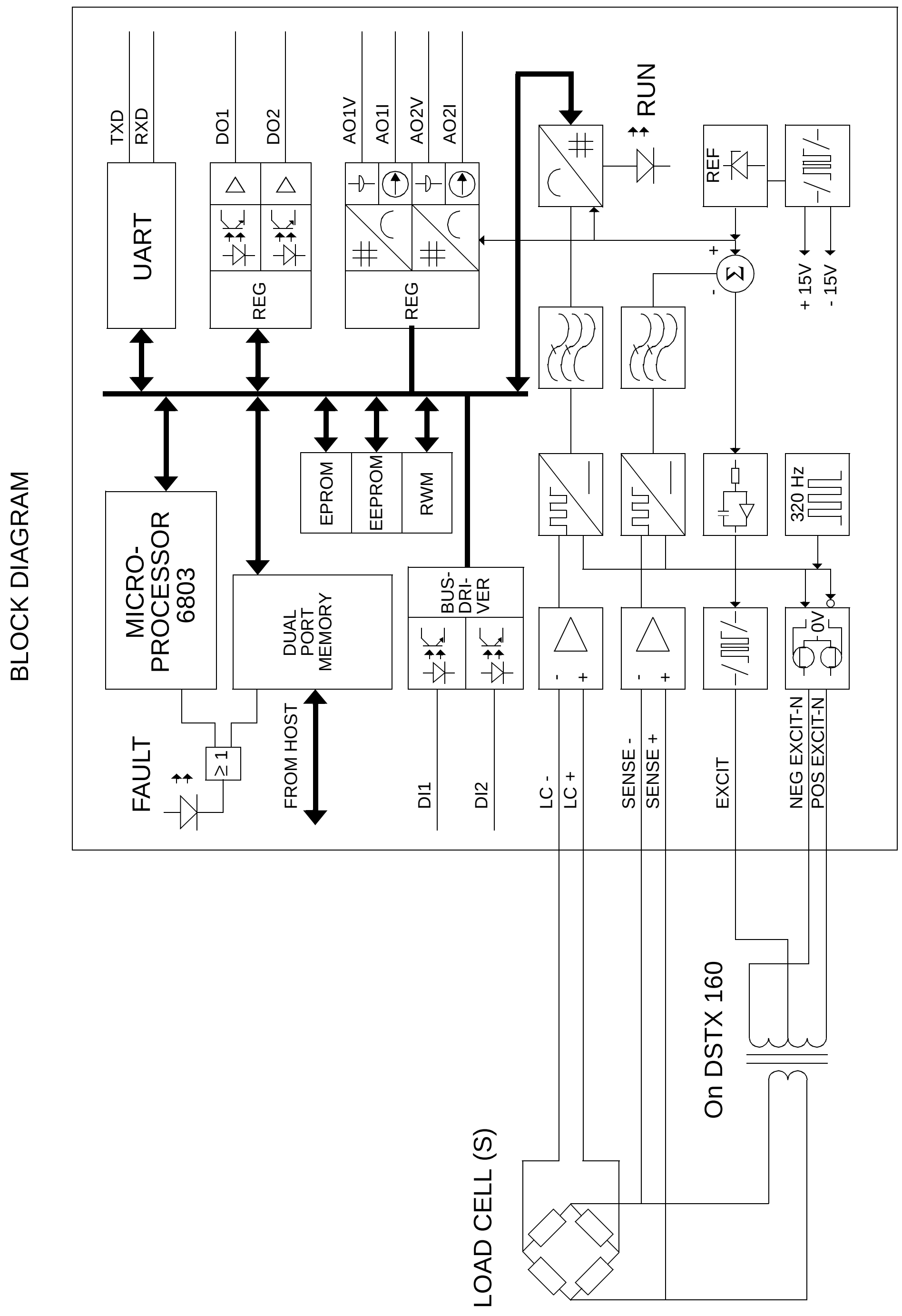


Figure 5-135. Weighing Board, Block Diagram

Weighing boards have the following functions:

Weighing boards are made for connection of one scale only. The boards have one measurement signal channel for connection of strain gauge load cells. On the boards, there are two digital input signals for zero setting of the gross weight and taring of the net weight. Two digital output signals are available for control of batching feeders. Finally, there are two analog output signals for presentation of weight and rate of change of weight.

The weighing boards have an eight-bit processor which controls the signal processing and performs the weight calculations, batching and rate of change of weight. It also assists in calibration, zero setting of gross weight and taring of net weight.

Short response times for control of batching feeders are available through the two digital output signals on the boards.

For emergency operations, you can use weighing boards as a scale without the control system running, since it possible to zero set and tare the scale via two digital input signals. The two analog signals can drive external panel meters or analog instruments.

A serial V24/RS 232C port is located on the front of the weighing boards. You can use the port to connect an external aid, such as a terminal with keyboard and display. You can set parameters and calibrate and inspect data via the terminal.

Boards and connection units have key data, as shown in Table 5-70 through Table 5-74.

Table 5-70. Weighing Board DSXW 110/DSXW 111, General Data

Description	Type	Ordering No
Circuit board	DSXW 110	5712 0001 - PG
	DSXW 111	5712 0001 - RF
Connection unit	DSTX 160	5712 0001 - PM
Cable between DSXW and DSTX	DSTK 186	2639 06 - DA

Table 5-71. Weighing Board DSXW 110/DSXW 111, Measurement Data

Data	DSXW 110	DSXW 111
Supply	± 10 V square voltage, 320 Hz with RMS value 10 V. Maximum permitted load 50 Ω.	± 1.65 V 320 Hz measured after the safety barriers. Maximum permitted load 80 Ω.
Signal sensitivity	Max 3 mV/V for standard strain gauge load cells	Max 3 mV/V for standard strain gauge load cells

Table 5-72. Weighing Board DSXW 110/DSXW 111, Digital Input/Output Data

Data	Digital Input	Digital Output
Number of channels	2 (opto-isolated)	2 (opto-isolated, short-circuit-protected transistor outputs)
Voltage rating	24 V d.c.	24 V d.c.
Input voltage, “1”	+15 - +35 V	-
Input voltage, “0”	-25 - +5 V	-
Load supply, max	-	33 V d.c.
Impedance	4 kΩ	-
Loading, max	-	150 mA
Filter time	5 ms	-
Voltage drop	-	max 2.6 V (max load)

Table 5-73. Weighing Board DSXW 110/DSXW 111, Analog Output, Data

Data	Analog Output
Number of channels	2
Measurement range (voltage)	0 - ±10 V
Measurement range (current)	0 - ±20 mA
Load (voltage)	≥ 500 Ω
Load (current)	≤ 500 Ω @ 20 mA
Resolution	12 bits + sign
Inaccuracy (voltage)	< 0.1%
Inaccuracy (current)	< 0.2%
Output impedance (current)	600 kΩ
Linearity	0.025%
Temperature drift: - Maximum - Typical	 0.1%/°C 0.005%/°C

Table 5-74. Weighing Board DSXW 110/DSXW 111, Power Consumption, Data

Data	DSXW 110/ DSXW 111
Current consumption, +24 V	170 mA
Current consumption, +5 V	1.25 A

5.10.1.1 Front Panel

The front panel of weighing board DSXW 110 is shown in Figure 5-136 below.

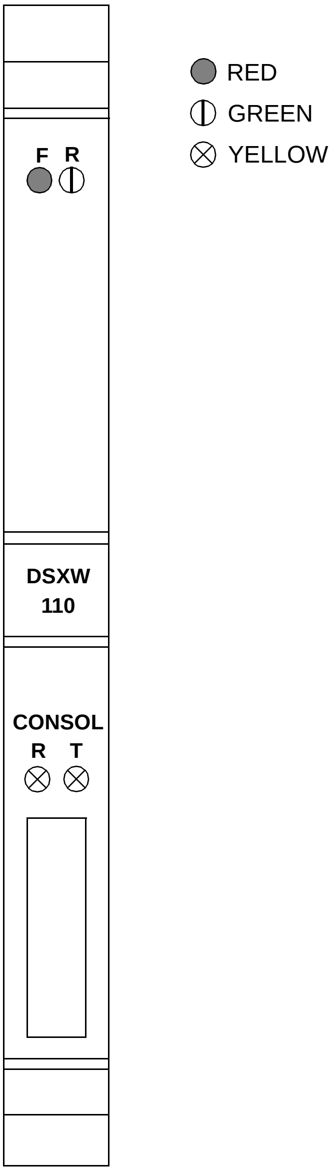


Figure 5-136. Front Panel of Weighing Board DSXW 110

The front panel for weighing board DSXW 111 is identical to the front panel shown above except it has the type designation DSXW 111.

The connections and indications on the front panel are as follows:

- indications

F	Error on weighing board
R	A/D converter running
CONSOL R	Communication on V24/RS 232C port, Receive
CONSOL T	Communication on V24/RS 232C port, Transmit

- connections
  - V24/RS 232C port

The socket for the connection of the V24/RS 232C port on the front panel has the following couplings:

Pins 1 and 5	Ground
Pin 3	Transmit data
Pin 4	Receive data

5.10.1.2 Jumpering of Weighing Boards

Weighing boards are switched for different functions, as shown in Table 5-75 below.

Table 5-75. Switching of Weighing Boards

Switch Function	DSXW 110	DSXW 111
Address	S1	
Production test	S2 and S3	
Future use	S4	

The location of the switch groups is shown in Figure 5-137 below.

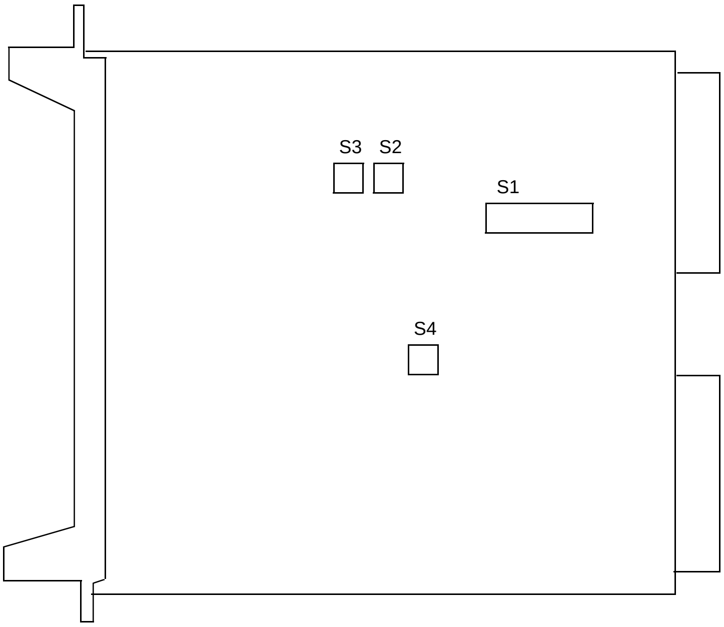


Figure 5-137. Location of Switch Groups, Weighing Board DSXW 110/DSXW 111

Address Switch

The address is jumpered on switch group S1. The address range for weighing boards is H’C0 - H’EF (hexadecimal).

See Appendix A Address Jumpering for examples of address jumpering.

Production Test switch

The switch groups S2, S3 and S4 are used for production test purposes only. They must remain jumpered as shown below.

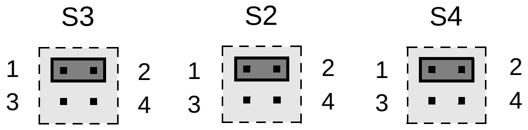


Figure 5-138. Jumpering of Production Test Switch

5.10.1.3 Connection of Weighing Boards to the Process

Brief information on the installation of strain gauge load cells is provided in *Weighing, User's Manual.*

Key data for the connection unit DSTX 160, which is used for weighing board connections to the process, are shown in the table below.

Table 5-76. Connection Unit DSTX 160, Key Data

Data	DSTX 160
Number of channels	2 analog output 2 digital input 2 digital output 1 V24/RS 232C connection
Number of scales	1
Cable to DSXW	DSTK 186
Number of connections (screw terminals)	40
Cable area (screw terminals)	0.5 - 2.5 mm^2

Three examples of connection of load cells to the weighing board are shown below.

Six (6)-wire connection includes measurement of the sense signal from the connection box QXAB 334. The cable from the connection box QXAB 334 to the connection unit DSTX 160 consists of a screened cable with three twisted pairs: supply (excitation), sense and measurement signals.

Four (4)-wire connection includes no measurement of the sense signal from the connection box QXAB 334. The cable from the connection box QXAB 334 to the connection unit DSTX 160 consists of a screened cable with two twisted pairs: supply (excitation) and measurement signals.

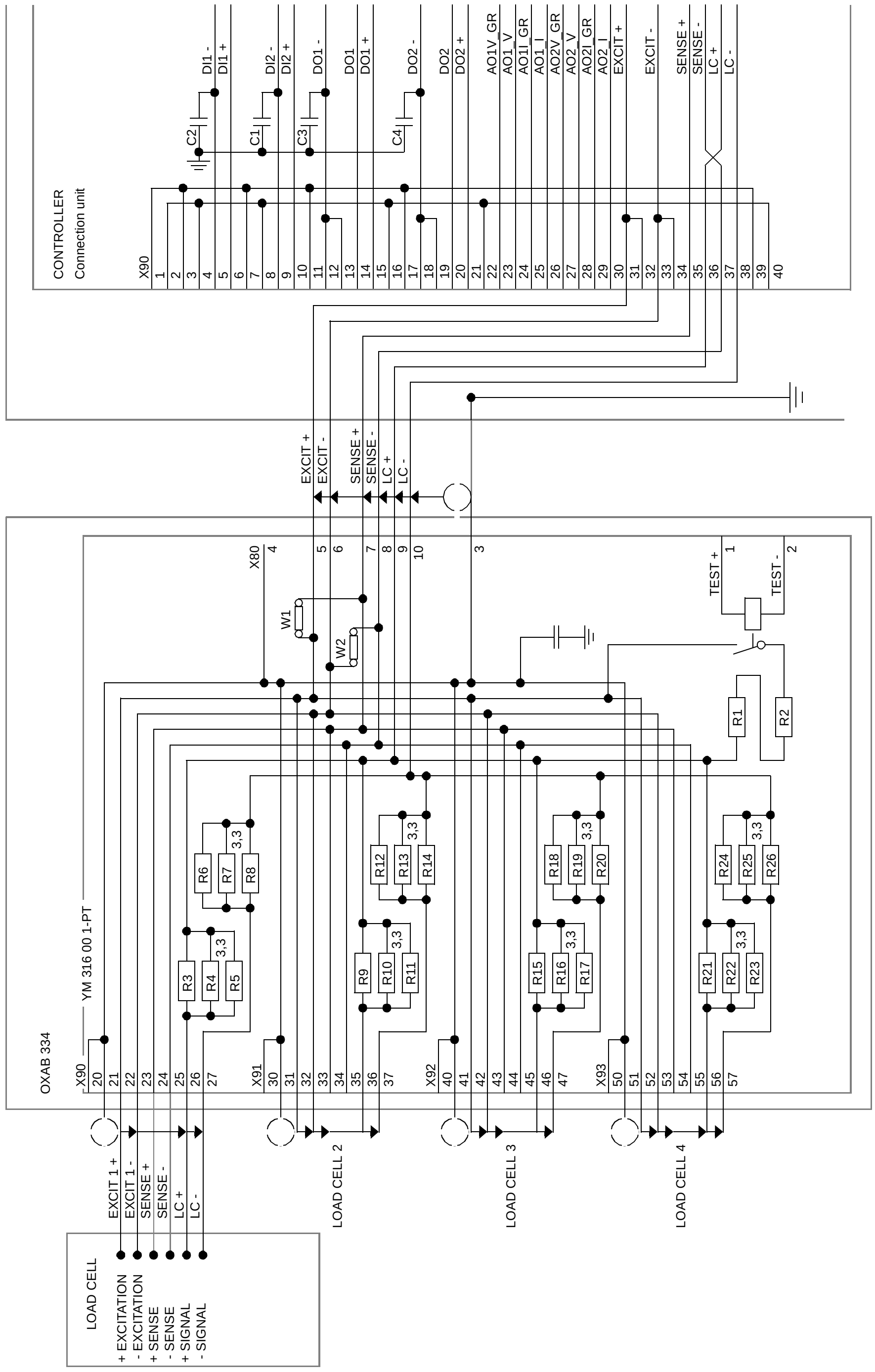


Figure 5-139. Connection of Load Cells, 6-Wire Connection, DSXW 110

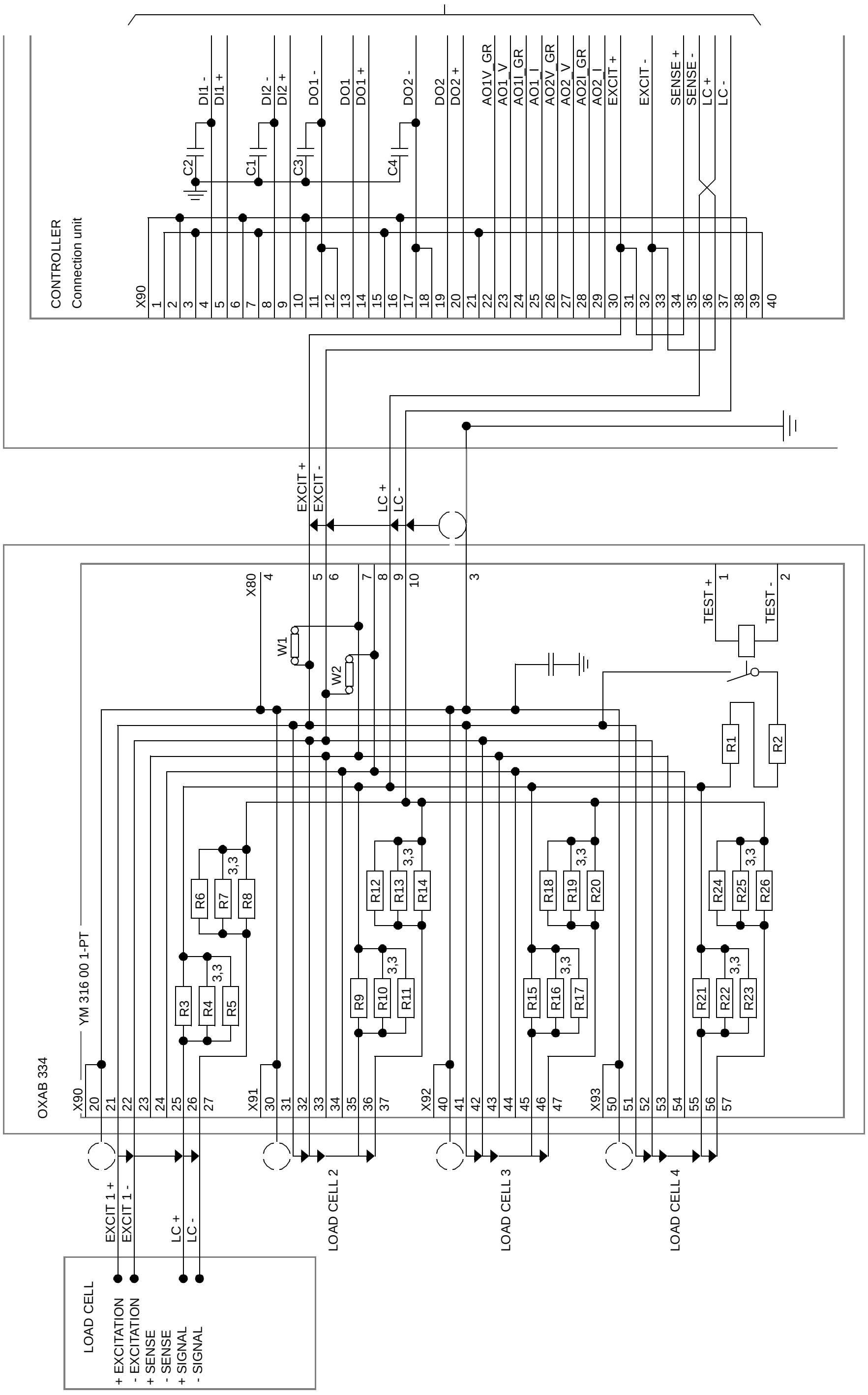
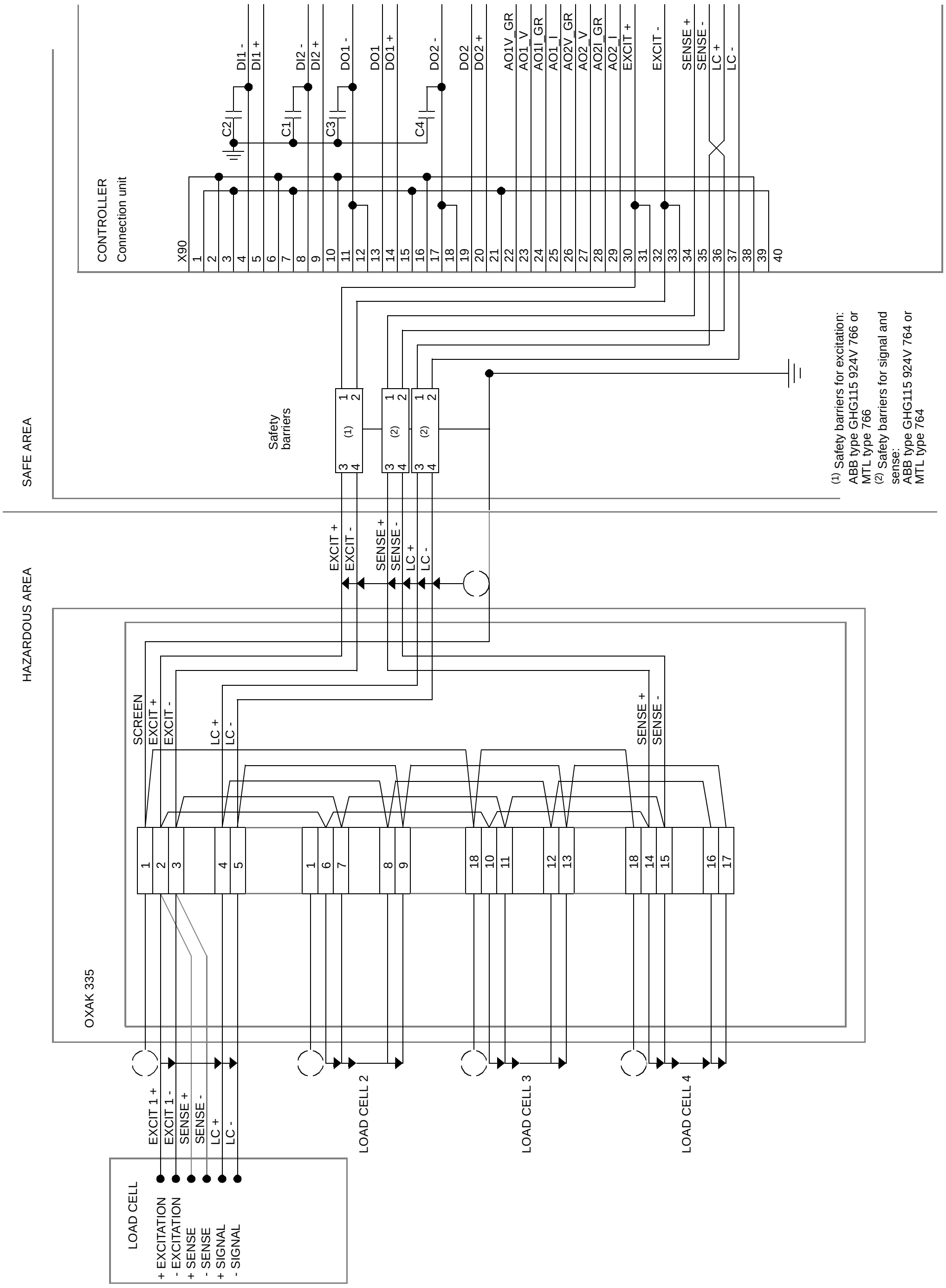


Figure 5-140. Connection of Load cells, 4-Wire Connection, DSXW 110



(1) Safety barriers for excitation: ABB type GHG115 924V 766 or MTL type 766
(2) Safety barriers for signal and sense: ABB type GHG115 924V 764 or MTL type 764

Figure 5-141. Connection of Load Cells, Safety Barrier Connection, DSXW 111

Six (6)-wire connections can be made with safety barriers for applications in hazardous areas. The barriers are normally mounted in the cubicle for electronics. There are special requirements on load cells, cables and connection boxes when installed in hazardous areas. The cables from the connection box QXAB 335 are connected to DSTX 160.

Connection of other weighing board input and output signals is shown in Figure 5-142 below.

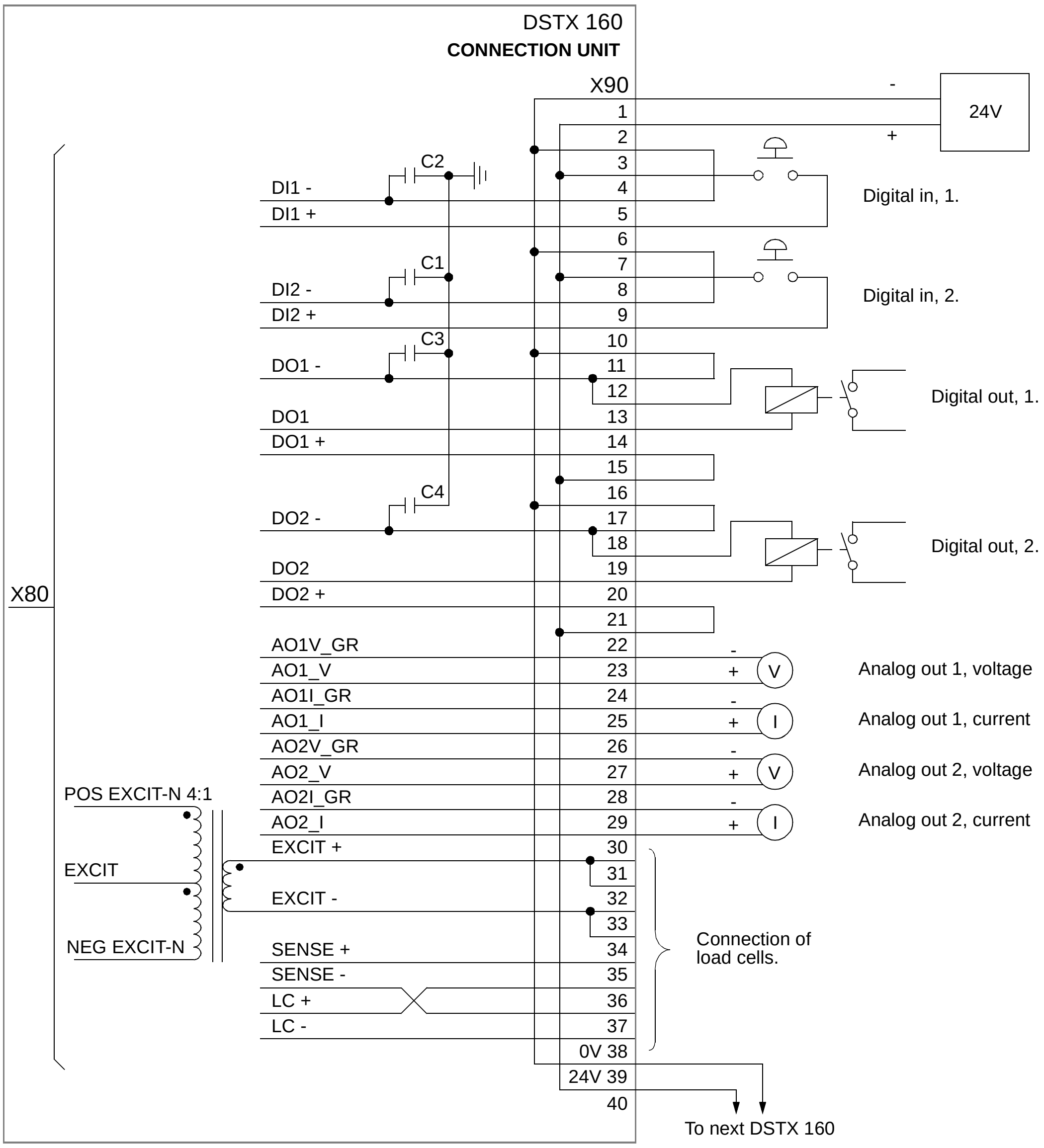


Figure 5-142. Connection of Input and Output Signals, DSXW 110/DSXW 111

5.10.1.4 Jumpering of Connection Unit for Weighing Boards

There are no jumpers on the connection unit DSTX 160. The figure below shows the location of the connectors on the connection unit.

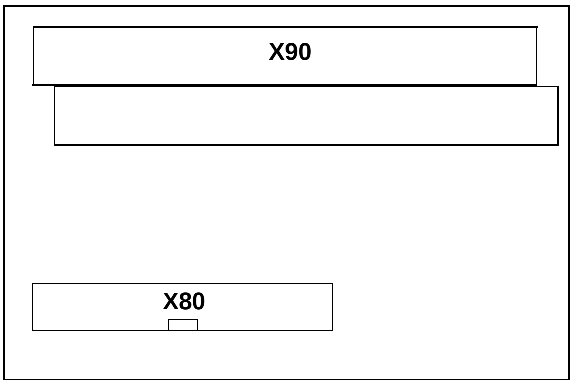


Figure 5-143. Connection Unit DSTX 160, Location of Connectors

5.10.2 Digital Speed Control Board (DSDC 111)

DSDC 111 is a drive control board. In addition to speed measuring, it also has functions for speed reference handling, positioning, emergency stop, monitoring and local operation.

The board consists of:

- nine digital inputs (DIN1 - 8 and SYNCIN),
- eight digital outputs (DOUT1 - 8),
- three pulse transducer inputs (CHA, CHB and CHC),
- two analog inputs (AIN1 - 2) and
- three analog outputs (AOUT1, AOUT2 and AOUTT).

A more detailed explanation of the inputs and outputs of the board follows.

Digital Inputs

Table 5-77. Digital Inputs, Key Data

Data	DSDC 111
Number of channels (opto-isolated)	8 + 1
Rated voltage	+24 V
Input voltage range, “1”	15 - 35 V
Input voltage range, “0”	0 - 5 V
Impedance	4.9 kΩ

Table 5-77. Digital Inputs, Key Data (Continued)

Data	DSDC 111
Transition level	Typ. +10 V
Filtering	Typ. 3 ms
Filtering “SYNCIN”	Typ. on 5 ms Typ. off 15 ms
Isolation test voltage, 50 Hz for one minute	500 V

Digital Outputs

The digital outputs are normally supplied from the board, but you can connect an external supply. If external supply is used, cut the solder jumper W2. See Section 5.10.2.2 Jumpering of DSDC 111.

Table 5-78. Digital Outputs, Key Data

Data	DSDC 111
Number of channels	8
Voltage rating	24 V (max 60 V)
Maximum load	75 mA
Voltage drop with max load	2.75 V

Pulse Transducer Inputs

If you use an external supply for the pulse transducer, then disconnect the internal +24 V supply by removing the solder jumpers W1 and W2 on the connection unit DSTX 110.
See Section 5.10.2.4 Jumpering of Connection Unit DSTX 110.

Table 5-79. Pulse transducer Inputs, Key Data

Data	DSDC 111
Type	Differential current inputs with opto-isolation
Number of channels	3
Input current	7 ≤ I ≤ 15 mA
Impedance	Typ. 200 Ω

Analog Inputs

DSDC 111 has two analog inputs: AIN1, which is intended for current measurement, and AIN2, which you can use as a reference input to AOUT2. (Select this via jumpers, see Section 5.10.2.2 Jumpering of DSDC 111.)

Table 5-80. Analog Input AIN1, Key Data

Data	**DSDC 111**
Type	Differential
Measurement range	0 - ±10 V
Input impedance	≥ 200 kΩ
CMV1)	≤ 100 V
CMRR2)	75 dB
Resolution (A/D)	9 bits + sign
Inaccuracy @ 25°C	≤ 1 1/4 LSB
Temperature drift	≤ 1 LSB/10°C
Limit frequency (3 dB)	6.5 Hz
Attenuation	40 dB/decade (> 40 times @ 50 Hz)

1) CMV = Common Mode Voltage
2) CMRR = Common Mode Rejection Ratio

Table 5-81. Analog Input AIN2, Key Data

Data	**DSDC 111**
Type	Differential
Input range	0 - ±10 V
Impedance	≥ 2 MΩ
CMV1)	≤ 10 V
CMRR2)	40 dB

1) CMV = Common Mode Voltage
2) CMRR = Common Mode Rejection Ratio

Analog Outputs

DSDC 111 has three analog outputs. AOUT1 and AOUT2 are ordinary outputs. Use the third output, AOUTT, which is available on the front, for test purposes.

Table 5-82. Analog Outputs, Key Data

Data	**DSDC 111**		
	AOUT1	**AOUT2**	**AOUTT**
Type	Bipolar voltage output		
Max load	≥ 500 Ω		
Measurement range	0 - ±10 V		
Resolution	11 bits + sign 4.883 mV/inc.	9 bits + sign 19.531 mV/inc.	9 bits + sign 19.531 mV/inc.
Inaccuracy @ +25°C	1 LSB		
Temperature drift	50 ppm/°C		

General Data

Table 5-83. General Data, DSDC 111

Data	**DSDC 111**
	DSTX 110
	DSTK 159
Current consumption +5 V	1.4 A
Current consumption +24 V	0.1 A (without load)
Interference immunity in acc. with pr.EN 50082-2	yes
Cable area (screw terminals on the connection unit)	0.5 - 2.5 mm^2

5.10.2.1 Front Panel

Figure 5-144 below shows the front panel of DSDC 111.

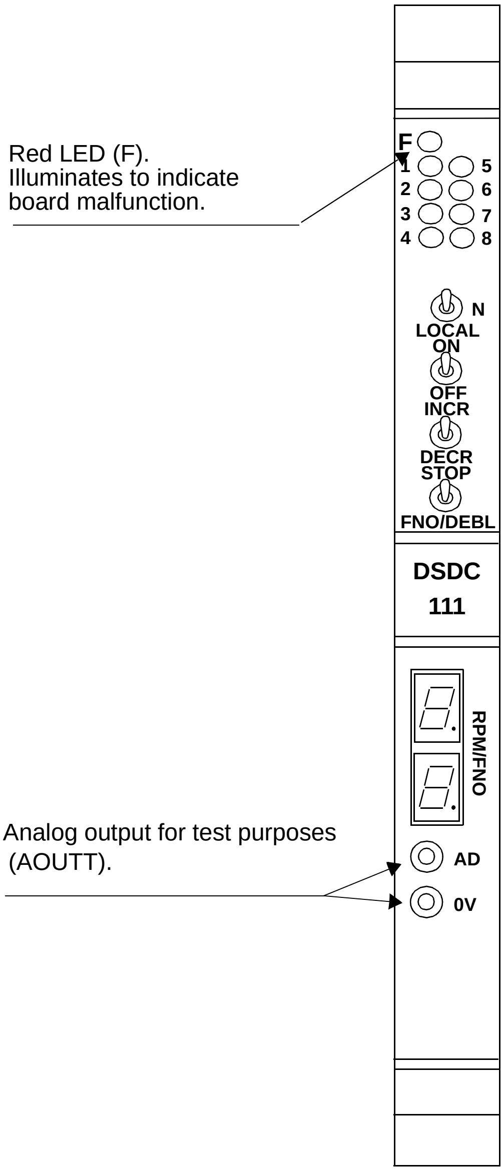


Figure 5-144. Front Panel of DSDC 111

5.10.2.2 Jumpering of DSDC 111

The board DSDC 111 is jumpered for different functions, as shown in Table 5-84 below. The location of the jumpers is shown in Figure 5-145.

Table 5-84. Jumpering of DSDC 111

Switch Function	Switch Groups
Address	S1
AOUT2 reference	S7
External supply (digital output)	W2
Production test	S6, S8, S9 and S10

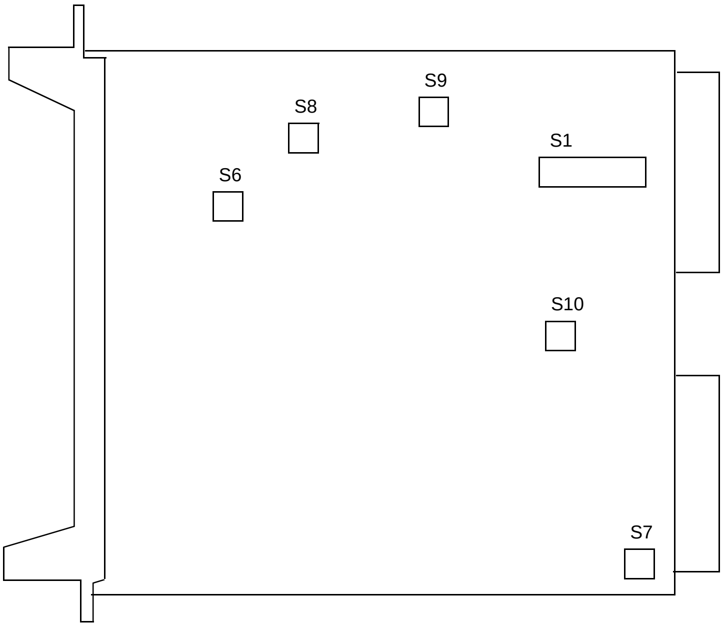


Figure 5-145. DSDC 111, Location of Switch Groups

Address Switch

The address is jumpered with the switch group S1 and the address range is H’C0 - H’EE (hexadecimal notation), which corresponds to 192 - 238 in decimal notation.

See Appendix A Address Jumpering for examples of address jumpering.

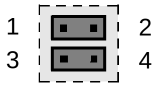
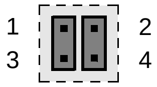
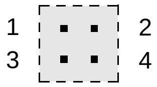
NOTE

An even address is selected via S1, but the board occupies the following odd address as well.

AOUT2 Reference Selection

Use switch group S7 to select the reference signal to the analog output AOUT2. See Table 5-85 below.

Table 5-85. Selection of AOUT2 Reference Signal

Function	S7
+10 V	
-10 V	
Controlled via AIN2	

Production Test switch

The switch groups S6, S8, S9 and S10 are used for production test purposes only. They should always be jumpered as shown in Figure 5-146 below.

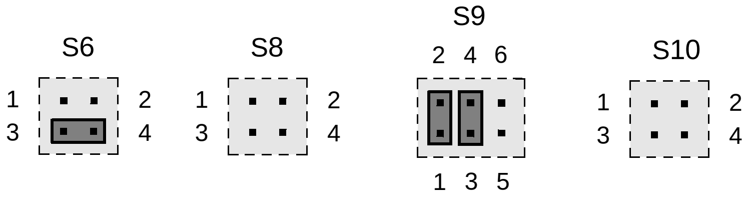
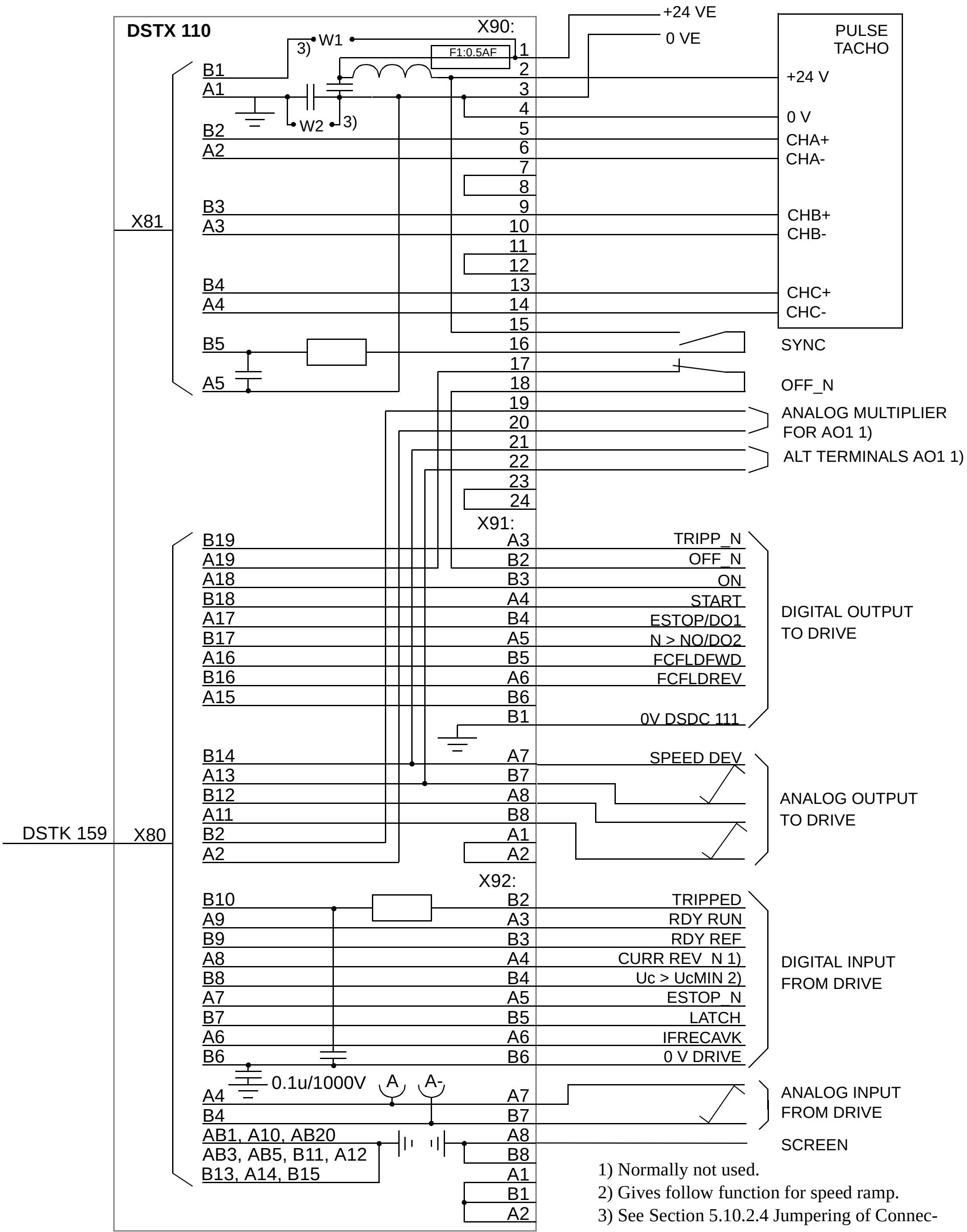


Figure 5-146. Jumpering of S6, S8, S9 and S10 on DSDC 111

5.10.2.3 Connection of DSDC 111 to the Process (DSTX 110)

Use connection unit DSTX 110 with cable DSTK 159 to connect to the process. An example of a connection is shown in Figure 5-147.



1) Normally not used.
2) Gives follow function for speed ramp.
3) See Section 5.10.2.4 Jumpering of Connection Unit DSTX 110.

Figure 5-147. Example of Connection of DSDC 111

5.10.2.4 Jumpering of Connection Unit DSTX 110

The location of the solder jumpers on DSTX 110 is shown in Figure 5-148 below.

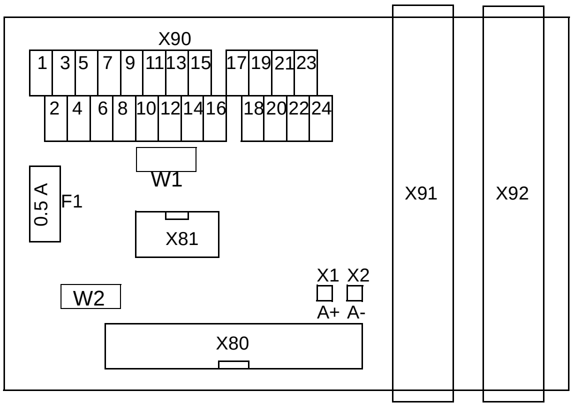


Figure 5-148. Connection Unit DSTX 110, Location of Solder Jumpers and Terminals

If you use an external supply for the pulse transducer, disconnect the internal +24 V supply by removing the solder jumpers W1 and W2 on DSTX 110. See Table 5-86 below.

Table 5-86. Selection of Internal or External Supply to the Pulse Transducer

Function	**DSTX 110**	
	W1	**W2**
Internal supply	IN	IN
External supply	OUT	OUT

5.10.3 Intrinsic Safety Support

Intrinsically safe S100 I/O solutions are provided by an interface to Intrinsic Safety System series 1000 from Elcon Instruments.

The basic principle of the interface is to replace the connection units of the S100 I/O- system with termination boards in the Intrinsic Safety Systems. The S100 I/O- systems will in such cases be delivered in cabinets without connection units and equipped with longer versions of the standard cables. For further details refer to Intrinsic Safety Support S100 I/O User’s Guide.

5.10.4 HART Protocol Interface

HART protocol interface for some S100 I/O- devices is provided by the use of special cables connecting S100 I/O- boards both to the connection unit and to HPORT HART multiplexers from Arcom Control Systems Ltd.

Hart interface for Intrisically safe S100 I/O solutions is obtained by the use of ELCON Sa 1700 Multiplexer together with the intrinsic safety interface from Elcon Instruments. For details regarding HART interface refer to HART Protocol Interface User’s Guide and regarding Intrinsic Safety support to Section 5.10.3 Intrinsic Safety Support in this manual and to Intrinsic Safety Support S100 I/O User’s Guide.

Appendix A Address Jumpering

A.1 General

The hexadecimal address value is transformed to binary form first. The jumper is then set to this binary value. This is illustrated in Figure A-1.

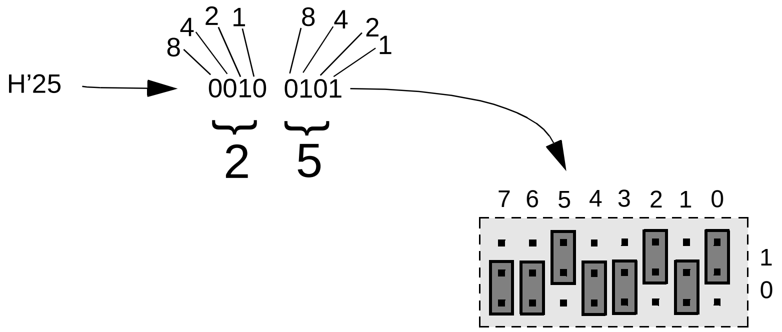


Figure A-1. Hexadecimal Value to Jumper

The different I/O boards are addressed within different ranges, depending on the I/O board type.

Some board have address switches instead of jumpers. For more information about each board’s addressing range, see the appropriate section in this manual. A list of addressing examples follows.

Table A-1. Examples of Address Jumpering on I/O Boards

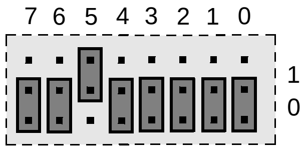
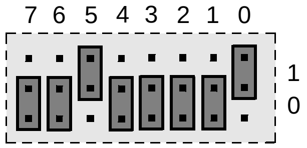
Address Represented		Jumpering of S1
Hexadecimal	**Binary (8 bits)**	
20	0010 0000	
21	0010 0001	
...	...	...

Table A-1. Examples of Address Jumpering on I/O Boards (Continued)

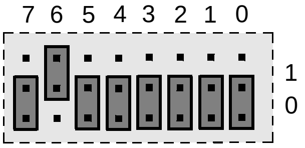
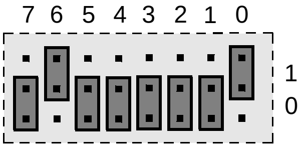
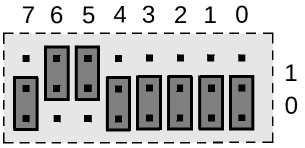
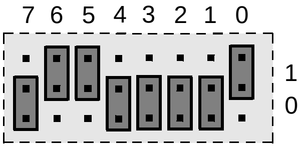
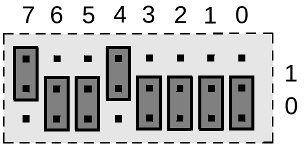
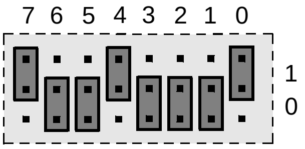
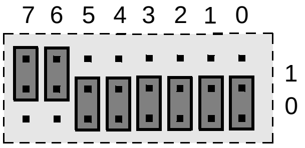
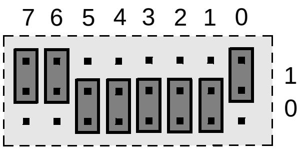
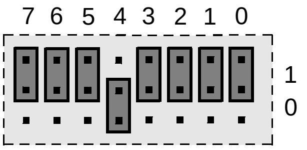
Address Represented		**Jumpering of S1**
Hexadecimal	**Binary (8 bits)**	
40	0100 0000	
41	0100 0001	
...	...	...
60	0110 0000	
61	0110 0001	
...	...	...
90	1001 0000	
91	1001 0001	
...	...	...
CO	1100 0000	

Table A-1. Examples of Address Jumpering on I/O Boards (Continued)

Address Represented		**Jumpering of S1**
Hexadecimal	**Binary (8 bits)**	
C1	1100 0001	
...	...	...
EF	1110 1111	

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